No. 1.— *On the Eared Seals* (Otariadæ), *with detailed Descriptions of the North Pacific Species*, by J. A. Allen. *Together with an Account of the Habits of the Northern Fur Seal* (Callorhinus ursinus), by Charles Bryant.

I.

Introduction.

The specimens on which the present essay is mainly based were collected by Captain Charles Bryant, at St. Paul's Island, one of the Pribyloff Group, situated near the coast of Alaska, and by him kindly presented to the Museum of Comparative Zoölogy. They consist of two perfect skins and two complete ligamentary skeletons of the *Eumetopias Stelleri* Peters, and six perfect skins, four complete ligamentary skeletons and two partial skeletons of *Callorhinus ursinus* Gray. The skins were sent preserved in salt, and arrived in excellent condition. The specimens of *Callorhinus ursinus* represent both sexes of this species and the young, both in skins and skeletons; while the notes kindly furnished by Captain Bryant give a minute account of its habits. A summer's residence at the Pribyloff Islands, as government supervisor of the seal fisheries, has given Captain Bryant an opportunity of becoming thoroughly familiar with the habits of these interesting animals, and the description he has given of them shows that he made a good use of his opportunites. His notes, given in full, form part second of the present paper. In addition to the specimens collected by Captain Bryant, I am indebted to the Smithsonian Institution and the Chicago Academy of Sciences for the opportunity of examining skulls of *Zalophus Gillespii* and *Otaria jubata*. I have also in this connection to make acknowledgments to Dr. Theodore Gill of Washington for various suggestions and other acts of kindness.

The only previous account of the Northern fur seal which has any great importance is that given by Steller, nearly a century and a quarter ago, and the observations of Krasheninikoff, published a few years later in his History of Kamtchatka. Krasheninikoff's account, however, was doubtless wholly or mainly derived from Steller's notes. The remarkable accuracy of Steller's account, considering the time when it

was written, is fully confirmed by Captain Bryant, who seems to have been the first naturalist who has had an opportunity of verifying Steller's observations. The history of this species is now far more fully known than that of any of its congeners, and better in fact than the majority of our best known mammals. A remarkable similarity of habits, however, so far as known, seems to pervade the whole group of eared seals, — a similarity which in many respects extends also to the walrus and the sea elephant (*Macrorhinus elephantinus*). As matter of collateral interest, for comparison with the account given by Captain Bryant of the species so fully described by him, the principal notices of the habits of the other species of the family have been cited as footnotes to Captain Bryant's article, and occasional abstracts are given of those most pertinent to the subject.

Through the important labors of Messrs. Gray, Gill, and Peters our knowledge of the *Otariadæ* has recently been greatly increased; yet not a single species of the family has been hitherto very satisfactorily known. Regarding the able essays of these gentlemen published in 1866 as representing the state of our knowledge of these animals five years since, their somewhat discrepant opinions respecting the number of known species, their distinctive characters, and their mutual affinities sufficiently indicate how imperfectly they were then known. A comparatively large number of specimens of the *Otaria jubata* has since been received at different scientific museums, which, with the facts obtained from persons who have recently been able to observe this species in its natural haunts, have served to render it, up to the present writing, the best known of any of the family. The number of specimens formerly possessed by naturalists having been very small, and the sex, age, and habitat of the individuals they represented being generally but vaguely known, the unusually great differences resulting from individual variation, as well as from sex and age, which recent developments prove to exist in these animals, remained for a long time unsuspected, and are even now, it would seem, not fully appreciated by the few naturalists who alone have given them special attention. Hence there has arisen in many cases an almost unparalleled complication of synonomy and an unusually large number of nominal species.*

* The synonomy of *Otaria jubata*, for example, embraces no less than fifteen distinct specific names.

The collection of skins and skeletons above mentioned of two of the North Pacific species which has recently been received at the Museum of Comparative Zoölogy throws much light not only upon these species but also upon several of the others. The investigation of this material has led the writer to an examination of the whole group, the results of which are herewith presented.

Dr. J. E. Gray and others have recently made known the fact that great differences in the form of the skull in *Otaria jubata* result from differences in age. Also the existence of remarkably great sexual difference in size has been long established; whilst Professor Peters, of Berlin, has recently pointed out extraordinary variations in the dentition of *Zalophus Gillespii*. The specimens of *Callorhinus ursinus* and *Eumetopias Stelleri* in the Museum of Comparative Zoölogy show that greater and more radical differences even in the osteological characters than those previously known are to be expected in all the species. The two adult male skulls of the *Eumetopias Stelleri*, for instance, differ from each other so much in form that, if their habitat was not precisely known and the evidence of their co-specific relationship unquestionable, one might well be excused for regarding them as belonging to distinct species; and the same is true of the two adult male skulls of *Callorhinus ursinus*. These specimens also show that some of the characters that have been relied on most frequently as affording generic distinctions, — as the form of the palatal surface of the intermaxillaries and of the hinder edge of the palatal bones, — vary so much, not only with age, but in specimens of the same age, that no given form of these parts can be regarded as affording even reliable *specific* characters. The great degree of asymmetry, especially in the skull, seen in these animals is sufficient to indicate clearly that an unusually great tendency to individual variation in these animals is to be naturally expected. Professor Peters has already referred to the presence of a supernumerary molar in one side of the upper jaw in two skulls of eared seals in the Leyden Museum, and another instance of the same abnormality is exhibited by one of the skulls of *Callorhinus ursinus* previously referred to. Taken in connection with this tendency to variation, the interesting fact that the number of synonymes pertaining to the several species is in almost exact ratio to the number of specimens that naturalists have had for examination is readily explained. The incidental revision of the genera and species embraced in the present paper is based on these recent developments.

The greatest number of species recognized by any writer during the last five years is fifteen; but they have now been reduced, by general consent, to ten or eleven. These have been placed by Dr. Gray, in his later papers, in *ten genera*. In the present enumeration six species * are regarded as fully established, and two or three other species † are given as doubtful. All are referred to five genera. ‡

One of the most singular facts connected with the history of these animals is that they should have so long remained among the species least known to naturalists, when their commercial importance is such that their capture has given employment to thousands of men and millions of capital for more than a century.

For many years, as is well known, hundreds of thousands of the skins of the Falkland Island fur seal, and hundreds of tons of the oil of other species, annually reached England; yet specimens of either the fur seals, or of any of the other species that naturalists were able to obtain, were exceedingly few and imperfect. Add to this the fact that, in many cases, the localities whence these fragmentary and isolated specimens were received were frequently wholly unknown or but vaguely surmised, and we can well understand how it happened that only till within the last decade have naturalists been able to decide with certainty as to which of the species on their catalogues were to be referred the various fur seals of commerce.

I. *Résumé of Recent Contributions to the Natural History of the* Otariadæ.

A brief statement of the present state of our knowledge of the *Otariadæ* seems to be demanded in the present connection, inasmuch as since the publication of the last general synopsis of the subject our knowledge of the group has greatly increased, without the new facts having been given in a single summary. As a *résumé* of the contributions to the literature concerning this group of animals which have appeared during the last two decades would necessarily give such a statement, and also at the same time a connected history of the recent changes in their nomenclature and classification, a synopsis of the

* *Eumetopias Stelleri*, *Zalophus Gillespii*, *Z. cinereus* (= *lobatus*, Auct.), *Otaria jubata*, *Callorhinus ursinus*, *Arctocephalus falklandicus*.

† *Phocarctos Hookeri*, *Arctocephalus australis*, *A. antarcticus*.

‡ *Eumetopias*, *Zalophus*, *Otaria*, *Callorhinus*, *Arctocephalus*.

principal recent papers relating to the subject is accordingly here introduced. For references to earlier papers the reader is referred to the works cited in Dr. J. E. Gray's British Museum Catalogues of the Seals and Professor W. Peters's elaborate essay on these animals published in the Monatsberichte of the Berlin Academy for 1866.

The present notice of the literature of the *Otariadæ* begins with Dr. Gray's "Catalogue of the Seals in the British Museum," published in 1850, in which valuable work two genera (*Arctocephalus* and *Otaria*) and eight species* are recognized. The next paper requiring mention is that of Dr. McBain,† describing, in 1858, a new species (*Otaria Gillespii*) from a skull from the Gulf of California. A few months later Dr. Gray published some important notes relative to the Northern sea bear (*Arctocephalus ursinus* Auct.),‡ based on a skin and skull of an adult male from Behring's Straits, received at the British Museum by way of Amsterdam and St. Petersburg, under the name of *Otaria leonina*. This paper is accompanied by an excellent profile figure of the skull, which seems to be the only figure of the skull of this species that has been hitherto published.

Two weeks later Dr. Gray communicated to the Zoölogical Society another paper on the Eared Seals,§ in which the fur seal of the Cape of Good Hope was described anew from a specimen received by him from Paris, and of which he published a view in profile of the skull. He appends to this paper a synopsis of the genus *Arctocephalus*, in which he divides it into three unnamed sections, based on characters drawn from the skull. Short diagnoses are also given of the species, which he groups as follows: —

"I. *Arctocephalus ursinus;* II. *A. Hookeri;* III. *A. Delalandii*, *A. nigrescens*, *A. lobatus*, *A. Gillespii*." He also gives a profile figure‖ of a cast of the skull described by Dr. McBain as *Otaria Gillespii*.

Some months later the same indefatigable author published a paper

* These are *Arctocephalus ursinus*, *A. falklandicus*, *A cinereus*, *A. lobatus*, *A. australis*, *A. Hookeri*, *Otaria Stelleri*, and *O. leonina*.

† Proc. Edinburgh Royal Phys. Soc., Vol. I, p. 422.

‡ "On the Sea Bear of Forster, the *Ursus marinus* of Steller, *Arctocephalus ursinus* of authors," Proc. London Zoöl. Soc., 1859, pp 101, 102, Pl. lxviii.

§ "On the Eared Seal of the Cape of Good Hope (*Otaria Delalandii*)," Ibid, pp. 107–110, Pl. lxix.

‖ Ibid., Pl. lxx.

on the Sea Lions of the Coast of California,* with a profile figure of an adult male skull of what he supposed to be a new species (*Arctocephalus monteriensis*), but which proved to be identical with the *Otaria Stelleri* of authors, as first suggested by Dr. Gill. Another young skull was described and doubtfully referred to the same species, as was also the skin of a fur seal. The latter, however, is undoubtedly identical with the Northern fur seal (*Callorhinus ursinus*). In this paper he gives a new classification of the eared seals, in which he properly raised the first of the sections of his genus *Arctocephalus*, which he had previously instituted, to the rank of a genus (*Callorhinus*). The second and third sections he seems to have reunited, for which he retained the name of *Arctocephalus*. His genus *Arctocephalus*, as now restricted, he again divided into four unnamed sections. A valuable table of comparative measurements of the skulls of eight species is appended.

Seven years from the date last given (1859) carries us to the appearance of Dr. Gray's "Catalogue of the Seals and Whales," † published in 1866, during which interval little or nothing of importance was published relating to the group in question. In this Catalogue all the species of his "Catalogue of Seals" of 1850 are retained; the synonymy is brought up to date, and the species he and others had described since the appearance of that Catalogue are added. These are the *Otaria Gillespii* McBain (= *Zalophus Gillespii* Gill, the *Arctocephalus monteriensis* Gray (= *Eumetopias Stelleri* Peters), and the *Arctocephalus Californianus* Gray (= *Callorhinus ursinus*, in part or wholly), making the whole number of species thirteen. Only one of the three species supposed to be new, however, proved to be so.

The specific nomenclature is not changed from that adopted in his previous paper, so far as the species mentioned in that paper are concerned, and the introduction of one generic name is the only change from the generic nomenclature employed by him in 1850. Another new classification of the species of the genus *Arctocephalus* is given, in which the species are grouped in two primary sections and seven subsections, upon the arbitrary basis of the differences in the form of the bony palate. No new material is described, and but little new matter added, the Catalogue being essentially a compilation from his previously

* "On the Sea Lions, or Lobos Marinos of the Spaniards, on the Coast of California," Ibid., p. 557.

† "Catalogue of the Seals and Whales in the British Museum," 1866, pp. 44–60.

published papers, generally without any change in the language, and often embracing important typographical errors. In the Appendix, however, some interesting notes are added in respect to the manner in which the eared seals walk, and their attitudes when in a state of repose, he having had the opportunity of observing a living sea lion in the Cremorne Garden.

Nearly coincident with the appearance of Gray's Catalogue of Seals and Whales was the publication of a "Prodrome of a Monograph of the Pinnipeds," by Dr. Theodore Gill,* of Washington. This important paper presents to a great extent a new classification of the Pinnipeds, and introduces numerous changes of nomenclature. The walrus, the eared seals, and the earless seals, for the first time for many years,† are again regarded as forming distinct families, as by Brookes, to which are applied respectively the names *Rosmaridæ*, *Otariadæ*, and *Phocidæ*.‡ The name *Otaria*, of Péron, is restricted to the Southern sea lion (*Phoca jubata* Schreber); *Eumetopais* is proposed as a generic name for the Northern sea lion (*Leo marinus* Steller, = *Otaria californiana* Lesson, = *Arctocephalus monteriensis* Gray); *Zalophus* is proposed as a generic name for the *Otaria Gillespii* McBain, and *Halarctus* for a group for which the *Arctocephalus Delalandii* is named as the type; *Arctocephalus* F. Cuvier is substituted for the generic name of *Callorhinus*, proposed by Gray for the *Phoca ursina* Linné. Brief diagnoses of these genera are given, and a species is indicated as the type of each. A list of the North American species is also added.

While most of the changes introduced by Dr. Gill in his Prodrome are judicious ones, errors occur in respect to the names of the genera of the *Otariadæ*. These were speedily pointed out by Dr. Gray§ in a short critique upon Dr. Gill's paper, in which Dr. Gray calls attention to the fact that the type of *Arctocephalus* F. Cuvier was not, as Gill assumed, Steller's sea bear, as is clearly shown by Cuvier's figure of the skull of his type of *Arctocephalus*. Hence Gray properly reinstated his name *Callorhinus* for the generic name of Steller's *Ursus marinus*. He does not state, however, to what F. Cuvier's figure refers, this,

* Proc. Essex Institute, Vol. V, pp. 1–12, March, 1866.

† See my remarks on the synonomy of *Otariadæ* below.

‡ Catalogue of Brookes's Anat. and Zoöl. Museum, p. 36, 1828.

§ "Observations on the 'Prodrome of a Monograph of the Pinnipedes,' by Theodore Gill," Ann. and Mag. Nat. Hist., 3d Series, Vol. XVII, pp. 444–447, June, 1866.

as suggested to me by Dr. Gill, being first pointed out by Professor Peters.* The type of Cuvier's genus *Arctocephalus* being in all probability the *Arctocephalus Delalandii* Gray, *Halarctus* of Gill, based on the same type, became, as Gray points out, a synonyme of *Arctocephalus*.

Nearly contemporaneously with Gray's above-mentioned critique appeared an able paper on the *Otariadæ* by Professor W. Peters of Berlin.† In this essay Professor Peters reviews the whole family, and describes two species erroneously supposed by him to be new,‡ and gave figures of their skulls. The species are all described as *Otariæ*, but are arranged under seven named subgenera or sections,‖ which appear in the main to be natural groups. The characters on which these divisions are based are drawn, not from the skull alone, but from all the available sources, the length of the ears, and the presence or absence of underfur ("Unterwolle") being for the first time made use of as distinctive characters in determining the lesser groups; Gray and Gill in their classifications having, with slight exceptions, made use of only the characters furnished by the skull. The specimens of eared seals contained in the Berlin Museum are described with considerable minuteness, and the synonymy of all the species quite fully and carefully presented. Professor Peters agrees with Gray (though at the time of writing he could not have seen his [Gray's] paper) in referring *Halarctos* to *Arctocephalus* and in reinstating *Callorhinus*. The names of all the other genera recognized by both Gill and Gray were adopted by him for the names of his sections, and to which he added two others (*Arctophoca* and *Phocarctos*). The arrangement of Professor Peters for the first time separated the hair seals from the fur seals, and to this extent at least an advancement was made towards a natural classification. The fur and hair seals differ markedly from each other in

* Monatb. d. k. P. Akad. z. Berlin, 1866, p. 271.

† "Über die Ohrenrobben (Seelöwen und Seebären), *Otariæ*, insbesondere über die in den Sammlungen zu Berlin befindlichen Arten," Monatsberichte der k. P. Akadamie zu Berlin, 1866, pp. 261–281, with three plates.

‡ *Otaria Godeffroyi* and *O. Philippii*.

‖ (1.) *Otaria*, containing *O. jubata*, *O. leonina*, *O. Godeffroyi*, and *O. Byronia*; (2.) *Phocarctos*, containing *O. Hookeri* and *O. Ulloæ*; (3.) *Arctocephalus*, containing *O pusilla*, *O. cinerea*, and *O. falklandica*; (4.) *Callorhinus*, containing *O ursina*; (5.) *Eumetopias*, containing *O. Stelleri*; (6.) *Zalophus*, containing *O. Gillespii*, and *O. lobata*; (7.) *Arctophoca*, containing *O. Philippii*.

numerous other general features, as well as in the pelage, as will be more fully noticed hereafter. Fourteen species have been recognized, but three of them (*O. leonina*, *O. Byronia*, *O. falklandica*) he seems to have regarded as doubtfully distinct from others. He refers Gray's *Arctocephalus Delalandii* to the *Phoca pusilla* of Schreber, and (with a query, however) Gray's *Arctocephalus nigrescens* to the *Otaria falklandica* of Shaw.

In consequence of the publication of these papers of Dr. Gill and Professor Peters, Dr. Gray was led to a re-examination of the specimens of the *Otariadæ* in the British Museum, and in September of the same year he published the results of his investigations.* In this paper he for the first time regards the *Otariæ* as a family (though several other writers had done so previously), and speaks of certain features that indicate their superiority to the *Phocidæ*. He adopts an entirely different generic classification from that given by him a few months before,† both as to the number of genera and their mutual relations. The seven named sections of *Otaria* of Peters he admits to the rank of genera, with the limits ascribed to them by Peters. He adds also one "new genus" (*Neophoca*), based on his *Arctocephalus lobatus*, which species Peters had referred to Gill's genus *Zalophus*. Gray had now eight genera and three subgenera.‡ Only ten species being recognized by him as valid, he has now but a single species to each of his generic and subgeneric subdivisions. Although the paper is a somewhat important one, containing as it does many valuable suggestions, no really new matter is described in it.

Another paper on the Eared Seals by Peters § immediately followed this one of Gray. In the few months intervening since the publication of his previous essay on this subject, Professor Peters had visited England and Holland, and examined the specimens contained in the principal museums of these countries, including among them the specimens in the Leyden Museum described and figured in the Fauna Japonica,

* "Notes on the Skulls of the Sea Bears and Sea Lions (*Otariadæ*) in the British Museum," Ann. and Mag. Nat. Hist., 3d Series, Vol. XVIII. pp. 228–237, September 1866.

† In his Catalogue of Seals and Whales.

‡ *Arctocephalus* is divided into *Arctocephalus*, containing *A. Delalandii*; *Euotaria*, containing *A. nigrescens*; and *Gypsophoca*, containing *A. cinereus*.

§ A supplement to his previous "Abhandlungen über die Ohrenrobben, *Otariæ*." Monatsb. d. k. P. Akad. z. Berlin, 1866, pp. 665–672, November, 1866.

and those in the British Museum described and figured by Dr. Gray. A skull of Tschudi's *Otaria Ulloæ* is figured, and many interesting facts are given respecting several of the species described by him in his previous paper. A list of the species is added, and while all of those given by him a few months before are included in the enumeration, they are numbered in such a way as to indicate that his estimate of them had somewhat changed. The whole number is ten, but under No. 1 he has "Nos. 1 a," "1 b," and "1 c," and under No. 9, "No. 9 a."* One is left somewhat in doubt, however, as to whether he regarded these species as synonymous respectively with Nos. 1 and 9, or as subspecies. Gray's *Arctocephalus nigrescens* is now positively (previously with a query) referred to *O. falklandica* Shaw, to which species also his own *O. Philippii* is seemingly referred. Instead of dropping altogether his subgenus *Arctophoca*, based at first solely on his *O. Philippii*, which he now appears to regard as a nominal species, he transfers his *O. falklandica* from *Arctocephalus* to *Arctophoca*. The *Otaria Stelleri* of Schlegel is in this paper referred to *O. Gillespii* of McBain, instead of in part to the *O. cinerea* of Péron, and in part to the *Arctocephalus lobatus* of Gray, as both he and Gray had previously referred it. In addition to the determination of the character of Schlegel's *O. Stelleri*, the most important thing decided by this paper is the exact character of Tschudi's *O. Ulloæ*, of which Peters was able to figure and describe original specimens.

In addition to the above-mentioned five papers published in 1866,— an important year in the history of the literature of the *Otariadæ*,— Dr. Sclater states, in the Proceedings of the Zoölogical Society of the same year,† that a "young living male sea bear (*Otaria Hookeri*), captured near Cape Horn, in June, 1862, by a French sailor named Lecomte, had been added to the society's menagerie. This animal had been exhibited by its captor in Buenos Ayres, and in various parts of France and England, and is the one doubtless referred to by Gray in the Appendix to his Catalogue of Seals and Whales.

At about the same time Dr. Burmeister ‡ also gives a description

* *O. jubata* ex Forster and Blainville is given as "No. 1"; *O. Byronia* Blainv., as "No. 1 a"; *O. leonina* F. Cuv. as "No. 1 b," and *O. Godeffroyi* Peters, as "No. 1 c"; "No. 9" is *O. falklandica* Shaw, while his *O. Philippii* forms his "No. 9 a."

† Proceedings London Zoöl. Society, 1866, p. 80, January, 1866.

‡ Ann. and Mag. Nat. Hist., 3d Series, Vol. XVIII, p. 99, Pl. ix, February, 1866

and figure of a young skull of *Arctocephalus falklandicus*, and some interesting facts in respect to the distribution of the eared seals on the east coast of South America, where he says but two species exist. Under the improper name of *A. falklandicus*, he also refers to the specimen captured and exhibited by Lecomte. One is led by Burmeister's remarks to infer that he believed this specimen (and another which did not live to reach Europe) was captured in the Rio de la Plata. Later the death of this "sea bear" is announced in the Proceedings of the Zoölogical Society, and Dr. James Murie * reports the results of his investigations as to the cause of its decease.

The next paper of moment on the Eared Seals appeared in February, 1868, and is entitled "Observations on Sea Bears (*Otariadæ*), and especially on the Fur Seals and Hair Seals of the Falkland Islands and South America."† In this paper Dr. Gray refers briefly to the two papers of Professor Peters, and very properly remarks, as it seems to me, that Peters in his first essay "formed no less than five species from the skulls of the Southern sea lion (*Otaria jubata*), — *O. jubata*, *O. Byronia*, *O. leonina*, *O. Godeffroyi*, and *O. Ulloæ*." He reviews at some length the complicated synonomy of the Falkland Island eared seals, and raises his subgenera of *Euotaria* and *Arctocephalus* (previously mentioned) to the rank of genera, and redescribes the Falkland Island and South American species. These are, (1) the *Arctocephalus falklandicus* Gray ex Shaw, (2) the *Euotaria nigrescens* Gray, and (3) *Phocarctos Hookeri* Gray. Dr. Gray contends that Peters's *O. falklandica* is not the *O. falklandica* of Shaw, but that it is the same as his *Arctocephalus* (or *Euotaria*) *nigrescens*. The *Arctocephalus falklandicus* of Burmeister‡ he, as it seems to me, erroneously referred to his *Phocarctos Hookeri*, doubtless from Dr. Burmeister having referred Lecomte's specimen of the "sea bear" already mentioned, which was really the *O. jubata*, to the "*O. falklandica*." The description of the skin by Dr. Burmeister, in Professor Peters's second essay,§ shows the animal to have been a *fur* seal, the *P. Hookeri* being a *hair* seal.

The young male sea lion (or sea bear, as it was also called), which

* Proceedings London Zoöl. Society, 1867, p. 243.

† Ann. and Mag. Nat. Hist., 4th Series, Vol. I pp. 99–110, February, 1868.

‡ Ibid., 3d Series, Vol. XVIII, p. 99, February, 1866.

§ Monatsb. d. k. P. Akad. d. Wissensch, z. Berlin, 1866, p. 670.

lived for a time in the Zoölogical Garden, and which was figured by Dr. Sclater as *O. Hookeri*,* he says is identical with the *O. jubata*, — an opinion subsequently shared by Dr. Sclater himself.†

A few weeks later Dr. Gray published another paper, on the *Otariadæ*, entitled "Observations on the Fur Seals of the Antarctic Seas and the Cape of Good Hope, with Description of a new Species";‡ he having in the mean time received additional material. In this paper he remarks still further concerning the complicated synonomy of the Falkland Island fur seals, and respecting the habitat of the specimens of Weddell, described by Mr. R. Hamilton,§ and the differences between these species and his *A. cinereus* of Australia and the fur seals of the Cape of Good Hope. He also describes what he regards as a new species, from two skins from the Cape of Good Hope, which species he calls *Arctocephalus nivosus*. These skins differ from those of his *A. Delalandii*, he says, in being so nearly destitute of under-fur, except just on the crown of the head, that he was convinced they could not be dressed as fur seals.‖

In "The [Cambridge, Eng.] Journal of Anatomy and Physiology" for November, 1868,¶ Dr. McBain describes an imperfect skull of a female *Otaria jubata* from the Chincha Islands, which he calls "*O. Ulloæ?*" suggesting for it, however, the name *O. Graii*, in case it should prove to be new. In the same number of this journal Professor Turner** describes, as that of a new species (*Arctocephalus schisthyperoës* ††), a skull with a peculiar conformation of the palatine bones, from Desolation Island, which Dr. Gray examined later and referred to his *Euotaria nigrescens*.

In the Monatsbericht of the Berlin Academy for March of the same

* Proc. Lond. Zoöl. Soc., 1866, p. 80.

† Ibid., 1868, p. 190, foot-note, March, 1868.

‡ Ann and Mag. Nat. Hist., 4th Series, Vol. I, pp. 215–219, March, 1868.

§ Ibid., Vol II, p. 81, Pl. iv. 1838.

‖ In this paper Gray repeats a misstatement made by him in his last paper preceding this, viz. that the *Eumetopias Stelleri*, a true *hair* seal, is one of the few eared seals that "have a close, soft, elastic fur." See further remarks on this point beyond under *E. Stelleri*.

¶ Vol. III, p. 109–112.

** Ibid., p. 113–117.

†† In the "Zoölogical Record" for 1868 Dr. Günther changes this name to *schistuperus*. McBain's "*O. Ulloæ?*" he regards as a new species, for which he proposes the name of *Arctocephalus Graii*.

year a letter from Dr. Burmeister to Professor Peters* is published concerning the eared seals of the coast of the La Plata States. In this letter Dr. Burmeister restates his opinion† that only two species of these animals exist on the east coast of South America, one of which he regards as the *Otaria leonina*, and the other as the *Otaria falklandica* of Peters's first essay. Of the first of these he had examined a number of specimens, which he describes somewhat in detail, and remarks especially upon the great variations presented by different specimens in consequence of differences in age, and also upon the great amount of purely individual variation they present. He is consequently led to believe that the species described by Professor Peters in his first essay as *O. jubata*, *O. Byronia*, *O. leonina*, and *O. Godeffroyi*, form but a single species. These several nominal species he regards as based merely upon individual differences, and not constituting even "permanent races or varieties." In the statement of this opinion he was anticipated by Dr. Gray, who, as previously stated, one month earlier referred not only these, but also the *O. Ulloæ* of Peters, to the *O. jubata*. To the *Otaria falklandica* of Shaw Dr. Burmeister also refers the *O. nigrescens* Gray and the *O. Philippii* Peters, as it seems to me with evident propriety. This short article contains highly important information respecting the South American eared seals.‡

In the following month Captain C. C. Abbott§ communicated to the London Zoölogical Society some interesting notes on the haunts, habits, and external features of *Otaria jubata* and *Arctocephalus falklandicus*. Among other things, he remarks that, in the hundreds of skins of the former (*O. jubata*) he had seen, he "never saw on any of them anything approaching fur." Captain Abbott's notes are the more valuable from the fact that he has deposited skulls of both these species in the

* Monatsb. d. k. P. Akad. Wissensch. z Berlin, 1868, pp. 180–182. The same account is substantially given in the Anal. Mus. Buen. Ayr. 1868, p. 303; Act. Soc. Paleont., p. xxxix, and Zeitschr. ges. Naturw., XXXI, pp. 294–301.

† See Ann. and Mag. Nat. Hist., 3d Series, Vol. XVIII, p. 99, 1866.

‡ It is perhaps but proper to state in this connection that the specimens referred to by Dr. Burmeister in the above-mentioned paper were collected by Dr. G. A. Maack at Cabo Corrientes, near the southern extremity of Buenos Ayres (lat. 38° S.) They are the specimens referred to by Dr. Maack in his paper in "Der Zoologische Garten" (Jan. 1870), and in his notes to the present paper.

§ "On the Seals of the Falkland Islands," by Captain C. C. Abbott. Communicated, with notes, by P. L. Sclater, M. D., etc., Proc. Lond. Zoöl. Soc., 1868, pp. 189–182, March, 1868.

British Museum, so that it is well known to which species his remarks refer. In a note to this paper Dr. Sclater observes: "I agree with Dr. Peters * in thinking it best to retain the name *jubata* for the Southern species, and to call the Northern one *Stelleri*. I consider *O. leonina* Cuv. to be probably the same as *O. jubata*, as appears to be admitted by Dr. Peters in his last paper." † Dr. Sclater states that he was mistaken in referring the living specimen brought by Lecomte to the *O. Hookeri*, and agrees with Peters ‡ and Gray in regarding it as *O. jubata*.

At the first session of the Zoölogical Society of London, held in November, 1868, Dr. Sclater § announced that a young female sea lion (*Otaria jubata*), from the Falkland Islands, had been received during the preceding August at the society's menagerie. "This individual," he says, "was the only survivor of eight examples of this animal captured in various spots on the coast of the Falklands by Adolphe Alexandre Lecomte, ‖ the society's keeper, who had been sent out there by the council of the society for the purpose of obtaining living specimens of it." The different localities at which M. Lecomte met with this species are mentioned in this communication, from which it appears that both this animal and "the fur seal of the Falklands (*Otaria falklandica*)" are far less numerous than formerly. The latter species was observed in considerable numbers at the Volunteer Rocks.

M. Lecomte also brought home a considerable number of skins and skeletons of the sea lion, concerning which Dr. James Murie ¶ soon published an exceedingly interesting communication. Lecomte's collection consisted of parts of fifteen individuals of the *Otaria jubata*, and of one of the *Arctocephalus nigrescens* Gray. The latter species, however, was represented by merely the "pectoral extremities" of an adult female; the former by the skull and skin of an "adult male," ** the skins and skeletons — the latter nearly complete — of four adult females, the

* Monatsb. Berl. Ak. 1866, p. 670.

† Ibid., p. 670. ‡ Ibid., 666.

§ Proc. Lond. Zoöl. Soc., 1868, p. 527.

‖ François Lecomte, according to Dr. Murie. (See next foot-note.)

¶ "Report on the Eared Seals, collected by the Society's Keeper, François Lecomte, in the Falkland Islands," by James Murie, M. D., etc., Proc. Lond. Zoöl. Soc., Jan. 1869, pp. 100–109, Pl. vii, and two woodcuts.

** This specimen, according to Dr. Murie's measurements, was but little larger than the so-called adult female, and hence cannot have been adult. Respecting the

skin and partial skeleton of a young male, skins of two very young males,* skins of two young females, together with a partial skeleton of one of them, and five aged male skulls. The skins were preserved in salt, but the pelage of none of them was in perfect condition. The color of these skins is described in detail, and a few measurements are given of both the skins and skulls. The skulls are described only in general terms. The skull of a half-grown male is figured, as is also another skull of an adult female. Three figures of the animal (young male, adult female and young), showing its peculiar attitudes, also accompany the report. While the paper conveys highly important information in respect to these specimens, it is to be hoped that a far more detailed account of them will yet be given. Dr. Murie's paper also embraces valuable observations concerning the habits of these species, derived from M. Lecomte, who resided several months on the islands among them.

Dr. Murie remarks that he cannot agree with Dr. Gray, "that Dr. Peters's figured skull of *Otaria Philippii* is most nearly allied to *O. Stelleri* from California, inasmuch," he continues, "as I consider it nothing less than *O. Hookeri*"; both of these gentlemen evidently overlooked the fact that Dr. Peters states expressly that the *O. Philippii* has a *thick under-fur* ("die *dichte Unterwolle* ist rostroth"), whereas both the *O. Stelleri* and the *O. Hookeri* are true *hair* seals. On the other hand, Dr. Murie says he unhesitatingly supports Dr. Gray in his criticism of Dr. Peters as regards the species of sea lions termed respectively *O. Byronia*, *O. leonina*, *O. Godeffroyi*, and *O. Ulloæ*, as," he adds, "I am perfectly convinced they are but differently aged specimens of Forster's *jubata*." Dr. Murie further observes, and it seems to me justly, that the *Arctocephalus nivosus* Gray is "only a variety, seasonal, sexual, or of a different age" of a previously known species.

In October, 1869, Dr. Gray published some "Additional Notes on Sea Bears (*Otariadæ*)," † based mainly on an examination of three skulls from Desolation Island, and one from the Cape of Good Hope, which had recently been sent him by Professor Turner of Edinburgh.

comparative size of the sexes, see Captain C. C. Abbott's notes (Proc. Zoöl. Soc., 1868, p. 190) and Dr. Maack's remarks beyond. Also Burmeister's in the Monatsb. Akad. z. Berlin, 1868, p. 181; and D'Orbigny's in his Voyage dans l'Amérique Meridionale, Tome II, p. 140, 1839.

* About three months old, according to Sclater (Proc. Zoöl. Soc., 1868, p. 528).

† Ann. and Mag. Nat. Hist., 4th Series, Vol. IV, pp. 264 – 270.

The skull from the Cape of Good Hope is the one on which Professor Turner* had founded his *Arctocephalus schisthyperoës*. This skull Dr. Gray is induced to believe is that of a half-grown *Arctocephalus Delalandii*, presenting an individual abnormality in the form of the palatine bones. The three skulls from Desolation Island he refers to his *Euotaria nigrescens*. In his remarks respecting them he speaks of certain differences he had observed in the relative position of the hinder grinders in the Desolation Island skulls, and also in the form of the posterior nares. In this connection he also compares *Euotaria nigrescens* with *Arctocephalus Delalandii*, and says that the last upper molar teeth being "placed in front of the hinder edge of the front part of the zygomatic arch" in the former is, so far as the skull is concerned (on which his distinction of his groups is mainly based), all that distinguishes them. This difference, he says, is slight in the adult, but more marked in the young; but "even then," he adds, "the difference is more *imaginary than real*." We should hardly expect, after this admission, and his apparently appreciative remarks in the same paper on the notable differences he had observed in skulls he regards as specifically identical, that in his subjoined new synopsis of the "tribes and genera" of the *Otariadæ* he should place, as he has done, these two species in different genera! He remarks that he does not now regard the "form of the hinder opening of the nostrils, and the form of its front edge," as constituting "a good character." The position of the grinders he regards as affording reliable specific characters during youth, but that in maturity their form is so much altered by age, "and their position in different species so similar, that the distinction of the species becomes more difficult." He finally briefly recapitulates the principal distinctive family characters of the *Otariadæ*, and concludes the paper with a synopsis of its "genera and tribes." He having previously established as many genera as there are commonly recognized species,† no new genera could well be added. It is, nevertheless, a radically new classification, and one as arbitrary a could well be devised. The family is first divided into two primary groups, termed "sections." The first section embraces a single "tribe," called *Otariina*, containing the single species *Otaria jubata* of the east and west coast of Southern South America.

* See *antea*, p. 12.

† See his papers on the Eared Seals in the Ann. and Mag. Nat Hist. for 1866 and 1868.

The other section is divided into four "tribes," which are named respectively, (1) *Callorhinina*, (2) *Arctocephalina*, (3) *Zalophina*, and (4) *Eumetopiina*. The first embraces the single genus *Callorhinus;* the second, *Phocarctos*, *Arctocephalus*, *Euotaria*, and *Gypsophoca;* the third, *Zalophus* and *Neophoca;* the fourth, *Eumetopias* and *Arctophoca*, — ten genera in all. The short generic diagnoses given are drawn almost entirely from two exceedingly variable features of the skull, namely, the form and relative length of the palatal bones and the form and position of the teeth. The geographical distribution of the supposed genera is also indicated, in which the habitat of *Zalophus* is given as "South America," whereas it was founded solely on the *Otaria Gillespii* McBain of the North Pacific. Three alleged species are mentioned whose skulls, he says, are not known. These are, (1) *Arctocephalus falklandicus*, habitat, "New Georgia"; (2) *A. nivosus*, habitat, "Cape of Good Hope"; (3) "*A. Forsteri* Fischer" habitat, "New Zealand." The character of the latter I cannot satisfactorily determine. I have never seen an "*Arctocephalus Forsteri* Fischer" elsewhere mentioned; the *Otaria Fischeri* Lesson and the *Phoca Forsteri* Fischer* have usually been referred to the *A. falklandicus*. Gray's *A. Forsteri* seems to be based, judging from his references, exclusively on the "sea bear" of Dr. J. R. Forster,† whose habitat was the Cape of Good Hope, as Gray in another place specially states. But this species Gray in this paper regards as the same as the *Phoca antarctica* Thunberg ‡ and Fischer, § which, he says, is the same as what he had called *Arctocephalus Delalandii*, the name of which species he now consequently changes to *A. antarcticus*. Although Forster regarded the New Zealand fur seal as the same as the one he saw at the Cape of Good Hope, Gray's *A. Forsteri* seems to refer, from the habitat given, only to the New Zealand animal. I can see no evidence, however, of the New Zealand fur seal being specifically different from the fur seal of South Australia (*A. cinereus* auct.).

In this paper the dental formula of the eared seals is, for the first time correctly given by the author. ‖

* Synop. Mam., p. 232.

† Cook's Voyages, Vol. I, p. 174; Vol. II, p. 528.

‡ Mem. de l'Acad. de St. Petersbourg, 3d Series, Tome III, p. 322, 1811.

§ Synop. Mam., p. 242.

‖ For more than fifteen years, through some strange inadvertence, the dental formula of the molars of the eared seals was given in Dr. Gray's papers as "$\frac{6}{6} = \frac{6}{6}$."

In "Der Zoologische Garten" for January, 1870,† Dr. G. A. Maack describes his excursion to the Cabo Corrientes on the southern coast of Buenos Ayres (lat. 38° S.) for the purpose of obtaining specimens of the eared seals, and his difficulties in capturing them. He states that he met with both species (*Arctocephalus falklandicus* and *Otaria jubata* = *O. leonina* Maack) there, of both of which he secured examples. As these specimens had been previously described by Dr. Burmeister (l. c.), Dr. Maack's observations are mainly concerning the habits of the animals and the character of the locality. A figure of the *O. jubata* is also given, but through some mistake of the artist the limbs are improperly represented. The remarkable form of the nose, Dr. Maack informs me, correctly represents the specimen from which the figure was made. It differs greatly, however, in this respect from any other eared seal that has been figured or described, and may represent but an individual or abnormal variation.

In Mr. W. H. Dall's important work on Alaska † may be found valuable notes on the fur and other eared seals of the North Pacific, with a figure of the *Callorhinus ursinus* drawn from nature by Mr. Dall.

In addition to the above-mentioned scientific papers, other interesting articles of a popular character have recently appeared, but some of the statements given in them are evidently not wholly reliable.‡

In addition to the preceding summary of the more important of the recent contributions to our knowledge of the eared seals, the reader is

This mistake occurs in three consecutive synopses of the group (Cat. of Seals in Brit. Mus., 1850; Cat. Seals and Whales in Brit. Mus., 1866; Ann. and Mag. Nat. Hist., 3d Series, XVIII, 1866, — in the last case corrected, however, in the general list of errata appended to the volume), and twice in each synopsis (in the diagnosis of this group, called by him *Arctocephalina*, and in that of the genus *Arctocephalus*). The correct formula of the molars is, of course, $\frac{6}{5} — \frac{6}{5}$ for a part of the species, and $\frac{5}{5} — \frac{5}{5}$ for the others. In the diagnosis of *Arctocephalus* given in the "Catalogue of Seals and Whales" (p. 47), the molars are stated to be "$\frac{6}{6} — \frac{6}{6}$"; the molars of the *first, third,* and *seventh* species described under this genus are really, however, $\frac{5}{5} — \frac{5}{5}$, and in the others $\frac{6}{5} — \frac{6}{5}$.

† Vol. XI, pp. 1–8.

† Alaska and its Resources, Boston, June, 1870.

‡ One of the more important ones relative to the North Pacific species is a recent article in the "Old and New" Magazine (Vol. I, pp. 487–493, April, 1870), by Mr. O. Howes, Jr. In Hutchin's "Scenes of Wonder and Curiosity in California" (p. 187, figs. 1 and 2) are also a few interesting notes on the sea lions of the Farallone Islands. They contain, however, exaggerated statements, especially in respect to their size.

referred to three recent systematic synopses of the family for an expression of the later opinions relative to the genera and higher groups of the three eminent zoölogists who, within the last four years, have published special classifications of these animals, as no tabulated summary will properly represent them. These are Dr. Gill's "Prodrome," * Professor Peters's revision † of the genera and species, published in 1866, and Dr. Gray's synopsis ‡ of the "tribes and genera," published in 1869.

2. *On the Affinities, Distinctive Characters, and Synonymy of the Family* Otariadæ, *with Remarks on Sexual, Age, and Individual Variation, and a Conspectus of the Genera and Species*, etc.

Family **OTARIADÆ** Brookes.

Phocacea auriculata Péron, Voy. Terr. austr., II, 37, 1816.
Otariadæ Brookes, Cat. Anat. and Zoöl. Mus., 36, 1828.
"*Otarides* Gervais, Hist. Nat. des Mammifères, II, 305."
Otariidæ Gill, Proc. Essex Institute, V, 7, 1866.
Otariadæ Gray, Ann. and Mag. Nat. Hist., 3d Ser., XVIII, 228, 1866.
Otariina Gray, Ann. of Phil., 1825.
Arctocephalina Gray, Charlesworth's Mag. Nat. Hist., I, 583, 1837.
" Turner, Proc. Lond. Zoöl. Soc., 1848, 88; Ann. and Mag. Nat. Hist., 1st Ser., III, 422, 1848.
Otaria Péron, Voy. Terr. austr., II, 37, 1816.
" Peters, Monatsb. Akad. Berlin, 1866, 261, 665.

Distinctive Characters. — Body less attenuated than in the majority of the *Phocidæ;* more attenuated than in the *Rosmaridæ.* Fore limbs finlike, situated very far back. Hind limbs comparatively free; hind feet directed forward when the animal is at rest, and serviceable for terrestrial locomotion. The digits terminate in long cartilaginous flaps, connected at the base by membranes. Bones of the upper and fore-arm and corresponding bones of the leg very short, exceedingly stout and heavy. The digits of the hand successively decrease in length from the first; without nails, or with extremely rudimentary ones, situated at a distance from the edge of the hand. Outer digits of the hind limbs longer than the middle ones; the latter sub-equal, and provided with well-developed nails; the outer digits without nails or with very rudimentary ones, and much shorter and thicker than the inner digits. Pubic bones

* Proc. Essex Institute, Vol. V, pp. 7, 10, 11.
† Monatsb. d. k. P. Akad. z. Berlin, 1866, p. 670.
‡ Ann. and Mag. Nat. Hist., 4th Series, Vol. IV, p. 269.

not anchylosed, and in the female considerably separated. Acetabula opposite the posterior end of the second sacral vertebra. Ears provided with a sub-cylindrical external conch. The skull has a well-developed orbital process and an alisphenoid canal; the mastoid process is strong and salient, distinct from the auditory bulla, which is much smaller than in the *Phocidæ*. Molars either $\frac{5}{5} = \frac{5}{5}$ or $\frac{6}{5} = \frac{6}{6}$; canines, $\frac{1}{1} = \frac{1}{1}$; incisors, $\frac{3}{2} = \frac{3}{2}$; whole number of teeth, $\frac{2}{8} = \frac{2}{8} = \frac{18}{16} = 34$, or $\frac{10}{8} = \frac{10}{8} = \frac{20}{16} = 36$. Testes scrotal, situated as in the *Suidæ*.

Rank and Affinities. — The seals were all referred by the earlier writers to the Linnæan genus *Phoca*. Buffon was the first naturalist who recognized the division of the seals made by seamen into eared seals and earless seals, accordingly as they possessed or were devoid of external ears. Later Péron,* in 1816, regarded these two groups as genera, and gave to the eared seals the name of *Otaria*, leaving the earless seals in *Phoca*. Finally these two groups were regarded by Brookes,† in 1828, as constituting two families, the walrus, in his system, forming a third.

These groups have been generally recognized as natural, but their rank has been variously estimated by different authors. Turner ‡ regarded the eared seals, the earless seals, and the walrus as together constituting a single family, which he divided into three sub-families, — *Arctocephalina*, embracing *Otaria* and *Arctocephalus*; *Trichecina*, embracing only the walrus; and *Phocina*, embracing all the earless seals. He observes, however, in referring to the classification of the Pinnipedia made by Gray in 1837, § that if the sub-families of the *Phocina*, proposed by that author, be entitled to that rank, "the walrus and the Arctocephaline group, which differ so decidedly from the other seals, would almost seem entitled to the rank of families."

All writers, except Brookes and Gervais, previous to 1866, seem to have regarded these three groups as constituting a single family. Gill, however, in his Prodrome, ‖ considered them as distinct families, which view has since been adopted by Gray.¶

* Voy. Terr. aust., Vol. II, p. 37, 1816

† Cat. of his Anatom. and Zoöl. Mus., p. 36, 1828.

‡ Proc. London Zoöl. Soc., p. 88, 1848.

§ Charlesworth's Mag. Nat. Hist., Vol. I, p. 583.

‖ "Prodrome of a Monograph of the Pinnipedes," Proc. Essex Institute, Vol. V, p. 7, July, 1866.

¶ Ann. and Mag. Nat. Hist., 3d Ser., Vol. XVIII, p. 229, 1866.

Believing that they have a higher than a sub-family value, I adopt for the present the classification elaborated by Dr. Gill in his Prodrome, which is, it seems to me, the most natural arrangement of the Pinnipedes that has been proposed. Gill's arrangement places the *Otariadæ* between the *Phocidæ* and the *Rosmaridæ*. No serial arrangement of these groups can, I think, fully express their relative rank and mutual affinities. The *Otariadæ* are evidently the highest, though they seem intermediate in general features between the earless seals and the walruses. Their affinities, as they appear to me, may be indicated as follows: —

OTARIADÆ.

ROSMARIDÆ.

PHOCIDÆ.

While the *Rosmaridæ* are lower than the *Otariadæ*, and the *Phocidæ* are still lower than the *Rosmaridæ*, the latter evidently do not connect the other two groups.

The evidence of the superiority of the *Otariadæ* over the *Phocidæ* consists mainly in that modification of their general structure, and especially of the pelvis and posterior extremities, by means of which they have freer use of their limbs, and are able to move on land with considerable rapidity; the *Phocidæ*, on the other hand, move with great difficulty when out of the water. But the higher rank of the former is also indicated by their semi-terrestrial habits, the scrotal position of the testes, and in the nearer approach in general features to the terrestrial Carnivores, especially in the more posterior position of the acetabula. Most of these modifications are, however, nearly equally shared by the *Rosmaridæ*, indicating likewise that their true station is above that of the majority of the *Phocidæ*.

Primary Subdivisions. — The members of the *Otariadæ* form among themselves a closely connected group, as well as a well-defined one. But in general form, in size, in color and in the character of the pelage, two tolerably distinct divisions of the *Otariadæ* may be recognized, which in a general way correspond with the sea bears * and sea lions of seamen, and the fur seals and hair seals of commerce. F. Cuvier † was the first naturalist who recognized these divisions, he regard-

* The term sea bear, however, has been sometimes applied indiscriminately to fur and hair seals, and even to the *same animal* by the *same person*, as in the case of the first living specimen of *Otaria jubata*, exhibited in England.

† Mem. du Mus., Tome XI, p. 295 *et seq.*, 1824.

ing them as constituting two genera. To the first of these genera, embracing the sea bears, founded in fact on one of the Southern sea bears, (? *Arctocephalus Delalandi* Gray), he gave the name of *Arctocephalus*, and to the other, founded on the Southern sea lion (*Otaria jubata* Blainville), that of *Platyrhynchus*. These names indicate to some extent the differences seen in the general form of the head, in the two groups. In the first, or sea bears, the muzzle is narrow and pointed; in the other it is broad, and the aspect is more leonine. The name *Platyrhynchus*, however, is antedated by that of *Otaria* of Péron. Besides these differences in the shape of the head, the form of the body in the Arctocephaline species is more slender than in those of the other group. The hind feet, especially, are longer and slenderer, with relatively longer swimming-flaps at the end of the toes. Their size is smaller, and they differ in general color. The Arctocephaline species are also all provided with a dense, soft, thick under-fur, while the others are either entirely without under-fur, or possess it in too small a quantity to render the skins of any commercial value as furs.* These two groups are as well defined as the several sub-families of the *Phocidæ*, and are co-ordinate with them. If the *Otariadæ* constitute a group entitled to family rank, — and the so-called sub-families of the *Phocidæ* have truly a sub-family value, — the *Otariadæ* must be considered as divisible into two sub-family groups, of which the hair seals constitute one and the fur seals the other.

In respect to what names should be used for their designation, none seem in themselves more appropriate than those derived from the names of the leading genera of these groups, *Otariinæ* for the hair seals and *Arctocephalinæ* for the fur seals. These names, however, in a slightly altered form (*Otariina* and *Arctocephalina*), have been used on different occasions in widely different senses, especially by Gray; the first for the whole group of eared seals, and afterwards the other in precisely the same sense. Later, both were again used simul-

* I am aware of the alleged exceptions in the Otarys of Australia: the *Zalophus lobatus* Peters, a true hair seal, having, it is said, considerable under-fur when young. This is probably the case, to a greater or less extent, with the young of all the hair seals prior to the first moult. I feel sure, however, that it is quite different in character from the soft, long, dense fur of the true fur seals. It may be added that the genus *Zalophus* is in other respects, as in size and the general shape of the head, somewhat intermediate between the fur and hair seals, though its affinities are decidedly with the latter.

taneously, as the names of different sub-divisions of the group, but *Arctocephalina* still embraced both hair and fur seals. Later still, the same author restricted *Otariina*, so that it embraced but a single species, while the other, also greatly restricted in its scope, embraced still both hair and fur seals. In view of this confusion, the name *Trichophocinæ* * is proposed for the hair seals, and *Oulophocinæ* † for the fur seals, in allusion to the different character of the pelage in the two groups.

Hitherto, owing to the fact that our best classifications of them have been based mainly on the number and position of the molar teeth, the hair and fur seals have been associated pell-mell and in almost every possible mode of combination. Formerly *Arctocephalus* was a heterogeneous association of members of two widely different natural groups. Although of late the hair and fur seals have been usually placed in different genera, the genera of the one set have variously alternated in the systems of different authors, and in the different systems of the same author, with those of the other set.

Comparison of the Skeleton of the Otariadæ with those of the Principal Types of the Phocidæ.

The chief osteological differences which serve to distinguish the eared seals from the other types of the Pinnipedes, as the common *Phoca*, ‡ *Cystophora*, *Monachus*, *Macrorhinus*, and *Rosmarus*, § may be indicated as follows: —

Comparison of the Otariadæ (Eumetopias) *with* Rosmarus. — The eared seals (of which *Eumetopias* is here taken as the type) differ

* θρίξ = hair, and φώχη = *Phoca*.

† οὖλος = soft, φώλη = *Phoca*.

‡ The materials mainly used in the following comparisons consist as follows: (1.) Of the eared seals, two complete ligamentary adult male skeletons of *Eumetopias Stelleri*, and two adult male and two adult female complete ligamentary skeletons of *Callorhinus ursinus*. (2.) Of the earless seals, a complete adult male ligamentary skeleton of *Phoca vitulina*, and other partial skeletons of the same species; three complete ligamentary skeletons of *Cystophora cristata*, and two nearly complete disarticulated male skeletons of *Macrorhinus elephantinus*, besides partial skeletons of other species. (3.) Of the walrus, two complete ligamentary skeletons. Cuvier's figures of the skeleton of the "Phoque à ventre blanc" (*Monachus albiventer*), Pander and D'Alton's of that of the *Otaria jubata*, and Schelgel's of that of *Zalophus Gillespii*, have also been examined.

§ *Trichechus*, as has been pointed out by Peters and Gill, was originally based by Linné (Syst. Nat., 10th Ed., 1758, I, 34) solely on the Manati (*T. Manatus*), and must hence be retained for that animal.

from *Rosmarus* in the form of the skull, in the relative length of the cervical vertebræ, in the form of the scapulæ, and in general proportions. In respect to the limbs, the principal difference consists in the relatively greater shortness of the foot in the walrus as compared with the other extremital segments (the femur and tibia posteriorly and the humerus and radius anteriorly), and the great divergence of the digits of the hind feet.

A skeleton of an aged male Alaska walrus I find varies in length but a few centimetres from that of an aged male of *E. Stelleri*. The dorsal and lumbar vertebræ have the same length in both, but the cervical vertebræ in the walrus are considerably shorter, and the caudal somewhat longer, than they are in the other. A vast difference, however, is seen in the general form, the *E. Stelleri* being slender and the walrus exceedingly robust, the bulk of the body in the latter being nearly twice that of the former. This gives a greater length to the ribs of the walrus, and much larger centrums to its vertebræ; but the development of most of the vertebral apophyses is nearly the same in both. The great thickness of the body also serves to increase the disproportionate shortness of the neck, as well as to increase the relative size of the pelvis and the divergence of the ilia. The limbs also are hence necessarily longer in proportion to the length of the body. The feet, however, are proportionally less developed than in the eared seals, and the whole form of the body indicates an animal of slow movements, especially in the water, and of rather sluggish habits.

The scapula in the walrus is long and narrow, with its greatest breadth near the middle, and its spine or crest situated but little behind the median line. In *Eumetopias* the scapula is short and broad, with its greatest breadth at the upper border, and its spine quite near the posterior edge. These considerable differences seem to result necessarily from the correlation of the form of the scapula with the great depth of the body.

The great differences which obtain in the skulls of these types, through the enormous development of the canines in the walrus, are too well known to require a detailed description. In the latter the skull is exceedingly massive throughout, but is especially developed anteriorly, to afford support to the immense tusks, while in *Eumetopias* it has the normal carnivore form.

The bones of the walrus, it may be added, are lighter and softer than

those of the eared seals, but they are far less so than those of some of the earless seals, especially *Macrorhinus*, in which they are more porous than in some of the cetaceans. All the sternal segments in the walrus are much less ossified than in the *Otariadæ;* in the former the first and ninth are almost wholly cartilaginous, leaving but eight ossified. In *Eumetopias* all are ossified, the first being also developed anteriorly into a long bony point, and the ninth similarly developed posteriorly.*

Hence the *Otariadæ* differ from the walrus type not only in many details of structure, but radically in the general form and proportions of the whole skeleton.

Comparison with the PHOCA VITULINA. — The eared seals differ vastly from the earless seals, as represented by *Phoca vitulina*, in almost every feature. In addition to the well-marked differences of form existing between nearly all the principal bones, there are remarkable regional variations which indicate a wide difference in the zoölogical rank of the two types. In the eared seals the length of the cervical and thoracic regions of the body, as compared with its whole length, is much greater than in *Phoca*, but in respect to the lumbar and pelvic regions the reverse of this obtains, these regions being most developed in the *Phocidæ*.† In the eared seals (*Eumetopias* and *Callorhinus*, which represent the two leading types of the eared seals) the ratio of the length of the cervical vertebræ to the whole length of the spinal column is as 19 to 100; in *Phoca vitulina* as 18 to 100. In the former, the ratio of the length of the dorsal vertebræ to the whole length of the spinal column is as 44 to 100; in *Phoca vitulina* as 37 to 100. That of the lumbar to

* See the detailed measurements of the skeletons of *E. Stelleri* and *Callorhinus ursinus* given beyond.

† The following table gives the dimensions (in mm.) and the proportions of the different regions in *E. Stelleri*, *C. ursinus*, *P. vitulina*, and the Alaska walrus.

	E. Stelleri. ♂	*C. ursinus.* ♂	*Ph. vitulina.* ♂	*Rosmarus.* ♂
Length of the cervical vertebræ	480	400	235	330
" " dorsal "	1.130	780	480	1,130
" " lumbar "	370	270	220	370
" " caudal "	520	310	370	580
" " spinal column	2,500	1,700	1.305	2,410
" " sternum	840	6.30	270	590
Ratio of length of cervical vert. to spinal column,	15-100	23-100	18-100	14-100
" " " dorsal " " "	43-100	44-100	37-100	47-100
" " " lumbar " " "	15-100	15.1-100	17-100	15.4-100
" " " caudal " " "	21-100	20-100	28-100	24-100
" " " sternum " "	34-100	36-100	20.7-100	24.5-100

the whole length is in the former as 15 to 100; in *P. vitulina* as 17 to 100. The same proportion in respect to the caudal vertebræ is in the former as 20 to 100; in the latter as 28 to 100.* The relative length of the sternum to the spinal column is as 35 to 100 in the eared seals, and as 28 to 100 in *Phoca vitulina*, indicating in the latter the relative shortness of the thorax as compared with the whole length of the animal, and hence its eminently cetacean form.

In regard to the skull, Turner† showed many years since that the eared seals are distinguished from the others by important cranial differences. He compares them as follows: In the earless seals "there is no trace of a postorbital process, nor of an ali-sphenoid canal; the mastoid can scarcely be said to constitute a process; it is swollen, and appears to form a portion of the auditory bulla, more or less connected with the tympanic portion, from which it is separated by a depressed groove running from the stylo-mastoid foramen backwards and a little inwards. The paroccipital process is never large in any of the family, but it is always distinctly developed and salient backwards. The Arctocephaline group are distinguished at once by their having a distinct postorbital process and an alisphenoid canal; the mastoid projects as a strong process, and seems, as it were, to stand aloof from the auditory bulla." In *Phoca* and in other types of the *Phocidæ*, the bulla is many times greater than in the *Otariadæ*, its increased size being doubtless compensatory for the absence of an external conch. In the latter the occipital and sagittal crests in old age attain an enormous development, which only a few of the higher forms of the *Phocidæ* at all approach.

Considerable differences are also found in the form of the different bones of the extremities of the two types. In the anterior extremities, these consist in the reduced size and structurally low form of the scapula in *Phoca*, as compared with *Eumetopias* and *Callorhinus*‡ (Figs. 12, 13,

* In *E. Stelleri* as 15 to 100; in *C. ursinus* as 23 to 100; in the latter there being a greater development of the post sacral vertebræ.

† Proc. Lond. Zoöl. Soc., 1848, p. 84.

‡ The general form of the scapula in these groups (including *Rosmarus* and *Macrorhinus*) is indicated by the following table: —

	Rosmarus.	*Eumetopias.*	*Callorhinus*	*Phoca.*	*Macrorhinus.*
Length	420	370	215	125	325
Breadth	230	405	280	110	215
Ratio of breadth to length .	6-10	11-10	13-10	9-10	6.6-10

and 16, Plate III). In the latter the acromion is developed almost as much as in the terrestrial carnivores, the crests are high, and the expansion of the blade very great. In *Phoca* the blade is small, expanded about equally anteriorly and posteriorly, the crest moderate, and the acromion process slightly developed. The greater tuberosity of the humerus, though large, does not rise above the base of the head of the humerus, whilst the lesser tuberosity rises as a sharp point to a greater height than the head of the humerus. In *Eumetopias* and *Callorhinus* these conditions are reversed, the lesser tuberosity being but slightly developed, whilst the greater is excessively so, rising to a greater height than the head of the humerus, and extending downwards more than half the length of this bone, — much farther than in *Phoca*. Differences are also traceable in the form of the bones of the forearm, carpus, and metacarpus. In respect to the digits of the hand, they differ less in size and length in *Phoca* than they do in the *Otariadæ* and in *Rosmarus*.

By far the most important differences, however, are found in the posterior organs of locomotion, — the pelvis and the hind limbs. The latter are relatively smaller in the *Phocidæ* than in the *Otariadæ*, and are very differently constructed and adapted to widely different uses, as indicated in the following comparison.

In the *Phocidæ* the hind limbs are extended backwards in a line parallel with the body; the legs are so enclosed within the integuments of the body that they have little or no motion, and the feet are movable only in a relatively small degree, in an obliquely lateral direction.

In the *Otariadæ* the hind limbs are somewhat free, and when in a natural position (on land) the feet are turned forward, and serve to raise the body from the ground.*

* It may be added that the foot is also relatively longer, as compared with the length of the leg, than in *Phoca*, as shown by the following table, whilst the differences in the size of the outer toes as compared with the middle ones is also greater.

	Eumetopias.	*Callorhinus.*	*Romarus.*	*Phoca.*
Length of fore limb	1,045	705	1,010	360
" " humerus	320	200	380	120
" " radius	275	205	270	110
" " hand	450	300	330	130
Ratio of length of hand to that of radius	16-10	15-10	13-10	12-10
Length of hind limb	1,000	705	1,040	600
" " femur	200	135	250	100
" " tibia	350	220	370	210
" " foot	450	350	420	290
Ratio of length of foot to tibia	13-10	16-10	11-10	14-10

In consequence of this peculiar structure the only purpose which these organs can subserve is that of swimming. On land progression is mainly accomplished by a wriggling serpentine motion of the body, slightly assisted by the extremities.

In the *Phocidæ* the tarsal articulation allows but a small amount of movement of the foot, which when naturally at rest forms but a slight angle with the leg.

In the *Phocidæ* no unusual sexual difference in the form of the pelvis is known to exist; the principal difference being that the pubic bones are united for a shorter distance in the females than in the males. In the *Phoca vitulina* the pelvis, seen from the front, presents a pyramidal outline, with the apex pointing backward. Laterally and ventrally its outlines are straight.

The ilia are short and broad (length and breadth about equal), expanding anteriorly in a transverse line. Their crests are turned abruptly outward and recurved, their posterior surfaces being concave.

The pubic bones are straight, slender, and subcylindrical; posteriorly they become flattened and somewhat expanded dorso-ventrally. In the male they are appressed posteriorly for one third their length, their point of widest divergence being at their anterior ends. In the females, however, they merely meet at the end,

They also (imperfectly) serve the purpose of walking; these animals being able to progress when out of the water several miles an hour, and to run for a short distance with nearly the rapidity of a man.*

In the *Otariadæ* the foot when similarly at rest forms with the leg an angle of at least 90°.

In the *Otariadæ* (in *Callorhinus* and *Eumetopias*† at least) there is an exceedingly great sexual variation in the form of the pelvis. In the males it is narrow throughout, and seen from the front the sides are nearly parallel for the greater part of its length, the pubic bones abruptly converging posteriorly, and the ilia diverging moderately at their anterior ends. The front outline is gently hollowed.

The ilia are elongated (twice as long as broad), flattened posteriorly, with their dorsal and ventral borders parallel, and no lateral expansion or recurvation of the crest.

The pubic bones are stout and subcylindrical, a little broader and thinner behind, approximating both anteriorly and posteriorly. Barely meeting (in the males) at the latter point, they form with each other a more or less broad ellipse, which is only slightly open anteriorly in *Callorhinus*, but more widely in *Eumetopias*. They

* See Captain Bryant's account, given below, of the habits of *Callorhinus ursinus*.

† The pelvis of *Callorhinus* differs from that of *Eumetopias* somewhat in certain details of its structure, as will be shown later in the comparison of these two species under *C. ursinus*.

much as in the *males* of the eared seals.

The ischia are dorsally arched, especially their dorsal margins, which rise in a high angular point opposite the posterior third of the thyroid foramen. Anteriorly they are subcylindrical, but posteriorly are flattened into broad thin blades, and unite with the corresponding parts of the pubic bones.

The thyroid foramen is an irregular elongated ellipse, its pubic outline being nearly straight.

The ilio-pubic spine is prominent, but the iliac tuberosity is wholly absent.

The middle of the acetabulum is situated a little in front of the posterior end of the *first* sacral vertebra, which is considerably anterior to its position in the eared seals.

Four fifths of the length of the innominate bone is posterior to the acetabulum, — in other words, the proportion of the length of the ischio-pubic part to the length of the ilia is as *three* to *one*.

The bones of the pelvis are all thin and slender.

are not partially united as in *Phoca*, but merely touch each other at their extremities, and are most widely separated at the middle.

The ischia are considerably arched above, but otherwise have nearly the same form and size as the pubic bones. Their dorsal margins have not the high angular prominence seen in *Phoca*.

The form of the thyroid foramen is nearly the same as in *Phoca*.

The ilio-pubic spine is very large, and the iliac tuberosity is not only present, but is enormously developed.

The middle of the acetabulum is situated but a little in front of the posterior end of the *second* sacral vertebra, — the length of the second sacral vertebra posterior to its position in *Phoca*.

Only slightly more than one half of the length of the innominate bone is behind the acetabulum. Hence the proportional length of the ischio-pubic portion to the ilium is nearly as *one* to *one*.

The bones of the pelvis are all thick and stout, especially the walls of the acetabula. The acetabula are themselves very much larger than in *Phoca*.

In recapitulation it may be stated that the essential or most striking pelvic differences in the males between *Phoca* and *Eumetopias* and *Callorhinus* consist in the abbreviated ilia, with their outwardly produced crests, the greater elongation of the pubic and ischiac bones, and the more anterior situation of the acetabula in *Phoca* as compared with the others.

In *Phoca* and the earless seals generally no great sexual differences in the structure of the pelvis appears to be known. From the great breadth of the pelvis between the pubic bones in the male, no modification of the male form of the pelvis would seem requisite in the female. In the eared seals, however, especially in *Callorhinus*, the pelvis is exceedingly narrow, especially anteriorly, in the males, and of small capacity. In the females it is hence necessarily entirely open in front, and the pubic bones and the ischia are reduced to a mere bony rim enclosing the very large thyroid foramen. The ventral borders of the innominate bones are also less produced. The more posterior position of the acetabula in the eared seals places the hind limbs in a position better fitting them to support the body, and hence for terrestrial locomotion. They are, in fact, placed but little anterior to their position in many of the true walking mammalia.

The following table of comparative measurements indicates the difference in proportions and form of the pelvic bones in *Phoca*, *Macrorhinus*, *Eumetopias*, *Callorhinus*, and *Rosmarus*: —

	Rosmarus. ♂	*Eumetopias.* ♂	*Callorhinus.* ♂	*Callorhinus.* ♀	*Phoca.* ♂	*Macrorhinus.* ♂
Length of the os innominatum . .	330	350	235	140	190	380
Breadth (externally) at iliac crests	330	160	110	975	135	—
" " at acetabula .	195	120	55	40	67	—
Length of ilium	180	150	100	60	50	130
Breadth (antero-posterior) of do. .	90	80	45	23	57	—
Length of ischium and os pubis .	250	200	135	70	140	260
Greatest breadth of ischio pubic bones	160	110	70	35	73	180
Length of thyroid foramen . .	150	125	65	45	87	150
Breadth " " . .	65	50	28	20	25	73
Transverse diameter of the brim .		40	15	25	40	—
" " of the inferior outlet		70	28	35	25	—
Ratio of length of ilium to ischium	72-100	75-100	71.5-100	86-100	28-100	50-100

Owing mainly to the great elongation of the very thick neck in the *Otariadæ*, the fore limbs, as long since mentioned by Cuvier,* are apparently placed much farther back than in the *Phocidæ*.†

The neural spines in *Phoca* are but slightly developed, especially anteriorly, whilst in *Eumetopias* and *Callorhinus*, as well as in *Rosmarus*, they are largely developed, especially those of the anterior dorsal verte-

* Oss. foss., Vol. V, p. 216.

† By actual measurement they are found to be but little anterior to the middle of the entire length of the animal.

bræ, which in *Phoca* are the smallest. These features, with others of a similar character, especially the high crests of the skull in all the eared seals, show these animals to be possessed of relatively much greater muscular power than the common *Phoca*, and that they are not only fitted for greater activity on land, but that they must also possess superior powers of motion in the water. The most strongly developed features in the skeleton of the *Phoca* type are those that best serve its strictly aquatic mode of life, and the character of its whole structure, as previously mentioned, gives it a rank far below the *Otariadæ*.

Comparison with Macrorhinus, Cystophora, *and* Monachus. — In respect to size the *Phoca vitulina* and the *Macrorhinus elephantinus* represent the two extremes, not only of the *Phocidæ*, but of the Pinnipedes, the sea elephant in size far exceeding the walrus. Yet in general osteological features *Macrorhinus* is strikingly like *Phoca*. In the form of the pelvis and scapulæ, however, it slightly approaches the *Otariadæ*, and what is known of its habits indicates that it has greater powers of locomotion on land than the common *Phoca*.

Cystophora differs in no important particular in the general skeleton from *Phoca* and *Macrorhinus*. *Monachus*, from Cuvier's* figure of its skeleton, much more nearly approaches the *Otariadæ*, and is hence a higher form than either *Macrorhinus*, *Phoca*, or *Cystophora*. The greater development of the neural spines and the other apophyses, the strongly developed crests of the skull, the very broad strongly keeled scapulæ, together with numerous other osteological features, indicate it to be an animal of great muscular power, whilst at the same time its comparatively slender form, and especially the elongated form of the thorax, indicate that it has a much nearer affinity to the *Otariadæ* than either *Macrorhinus*, *Cystophora*, or *Phoca* have.

These four forms — *Monachus*, *Macrorhinus*, *Cystophora*, and *Phoca* — represent four of the leading types of the *Phocidæ*. Their relative rank is doubtless in the order given, *Monachus* being unmistakably the highest and most like the *Otariadæ*. *Stenorhynchus*, it seems to me, is still lower than either of the above-mentioned genera. I should hence arrange the sub-families of the *Phocidæ* in the following order, with *Monachus* as the highest genus of *Phocinæ*, which is the highest sub-family:—

Phocinæ.

Cystophorinæ.

Stenorhynchinæ.

* Oss. foss., Tome V, Plate XVII.

Of the Sexual, Age, and Individual Variations.

Sexual Differences. — Whilst in the carnivores generally the sexual variations are considerable, especially in respect to size, they seem to never exist in greater degree than in the *Otariadæ*. In all the species of this family in which the sexes are well known, — especially in *Otaria jubata*, *Eumetopias Stelleri*, *Callorhinus ursinus*, and *Arctocephalus falklandicus*, — it has been found that the weight of the adult females is rarely above one sixth to one fourth that of the old males; — a sexual disproportion in size rarely if at all elsewhere met with in mammals. In the Pinnipedes the nearest approach to it is in the sea elephant (*Macrorhinus elephantinus*), which in some of its habits, as previously mentioned, also approaches nearer to the eared seals than any other well-known species of the *Phocidæ*.

The sexes differ also in *color*, the females being generally much lighter colored than the males.

They also differ in the size of the teeth, especially of the canines, the females having relatively, as well as absolutely, much smaller teeth than the males. The form of the palatal surface of the maxillaries also varies in the two sexes, in the females it being usually flatter or less depressed than in the males, and its lateral outlines straighter. The females also lack the high crests of the skull possessed by the males, and have the processes of the bones less developed.

One of the greatest sexual differences, however, is seen in the pelvis. In the female it is much smaller than it is in the male, and the pubic bones instead of meeting behind, as in the males (and also in the females in the *Phocidæ*), are widely separated, and with the ischia are reduced to a slender rim enclosing the large thyroid foramen; at least this is the case in *Callorhinus ursinus*, and there seems to be no reason for believing that similar differences in the structure of the pelvis do not exist in the other species of the *Otariadæ*.*

* Respecting the sexual differences in the *Otaria jubata*, Dr. G. A. Maack has furnished me with the following note: —

"The most striking feature in *Otaria jubata* is the great dissimilarity between the males and females, not only in respect to size and general external features, but also in their osteological structure. It is a curious fact, that, whilst the male changes greatly with age in respect to its osteological characters, the female presents in this respect a greater or less constancy of character. In color, however, the reverse obtains, — the males preserving a greater constancy in this respect, whilst the females vary exceedingly at different ages."

Differences resulting from Age. — In color the young differ from the adult, as in most mammals, in being very much darker, especially previous to the first moulting of the pelage. During the first few months the young of both sexes of the fur seals are black, whilst the old males are more or less brownish- or grayish-black, and the females cinereous. In the hair seals the young are dark reddish-brown, whilst the adult are pale yellowish- or grayish-brown. The first coat of hair in the young is somewhat different in character from that they have later, in both the fur and hair species. The latter, whilst quite devoid of fur in adult life, or possessing only an exceedingly sparse undercoat of crisp curled hair rather than fur, are said to have more or less "fur" when young. This is affirmed more especially of the *Zalophus lobatus*, but doubtless the young of all the hair seals have a softer coat than the adult.

In respect to the form of the skull, the young greatly differ from the adult, as is sufficiently indicated by the figures of the young and adult skulls of *Callorhinus ursinus* given in Plates II and III, and described in detail in the account of that species, and as is also shown in the figures of young and adult skulls of *Zalophus Gillespii* given in the Fauna Japonica (Mamm., Plate XXII). It appears that the brain-case early reaches its full size, and changes later mainly through the thickening of its walls. The facial portion is more slowly developed, so that the proportions of the very young and the mature skull are widely different. As regards the general skeleton, my material does not allow me to speak.

Individual Variation. — In order to determine what characters may be most useful in distinguishing genera and species, it is necessary to take into account the individual variation to which the different parts are subject, as well as the differences resulting from sex and age. Formerly, when but few specimens of any species of the *Otariadæ* were known, it was natural to suppose that any characters based on the adult form of the skull or of its different bones might be regarded as affording reliable specific and generic characters. As more material was acquired, it became evident that these parts in the present group were unusually variable, and hence to a great degree unreliable as the foundation for specific or even generic diagnoses. The general form of the skull, the depression of the bony palate, the posterior extension of the palatines and their posterior outline, and also the situation of the last molar relative to the anterior edge of the zygomatic foramen, and the number and form of the molars, have been generally taken as the basis

of generic divisions. All these parts, however, have recently been found to vary greatly, not only with age and sex, but in specimens of the same age and sex. The form of the hinder edge of the palatines, as to whether it be convex, truncate, or emarginate, has been especially relied on for the distinction of both species and genera, yet the specimens before me show that in the same species, in skulls of equal age and of the same sex, the posterior border of the palatines may be either truncate or deeply emarginate.

The situation and form of the molars also vary in a similar way, as does also the depression of the palate. The general form of the skull varies greatly in adults of the same sex, as shown by specimens of adult males of each of the three North Pacific species now before me; so much so, indeed, as to materially alter the relative proportions of the different regions. The form of the frontal region, or third segment of the skull, is especially liable to great variation, as indicated by the two male skulls of *Callorhinus ursinus* figured in Plate II (Figs. 1 and 2). Two skulls of the *Zalophus Gillespii*, received too late for illustration, show much greater differences in this respect than these do. They closely resemble in relative size and form the two adult male skulls of the same species figured in the Fauna Japonica (Mamm., Pl. XXII, Figs. 1–4). In the figures of these skulls, as seen from above (Fig. 2 and 3, l. c., Fauna Japon.), these differences are very strikingly shown. Through the deep and abrupt postorbital constriction of the skull, the latero-anterior angles of the brain-case are sometimes well developed, whilst in other specimens of the same species, age, and sex, through the less abruptness of this constriction, they are either but slightly prominent or obsolete. These differences give in one instance a *quadrate* form to the brain-case, and in the other a *triangular* form. The length of the postorbital cylinder of the skull is also an exceedingly variable element, the difference amounting in some cases to nearly thirty per cent, and hence greatly changes the general form of the skull.

The great degree of asymmetry exhibited by these animals may be also cited as evidence of an unusually great tendency to variation.* Further evidence of the same tendency is seen in the somewhat frequent occurrence of supernumerary molars in the upper jaw, — instances of which will be presently cited.

* See remarks on this point beyond, under *Eumetopias Stellerı*.

The form and position of the molars in the same species is also far too variable to be of much taxonomic value, even in respect to genera,* although they form one of the principal elements on which has been based one of the latest generic revisions of the group.†

The roots of the molars often vary considerably in the two sides of the jaw in the same specimen, and most markedly in different co-specific specimens of the same sex and age. In one of the males of *C.*

* The details of the individual variation shown in numerous points by my specimens of the North Pacific species will be more fully given later.

† In October, 1869, Dr. J. E. Gray published the following classification of the *Otariadæ*, based, as will be seen, on a few eminently variable characters of the skull and teeth. That it should have been otherwise than palpably unnatural and arbitrary could hardly be expected. The *alleged* differences between the genera are very slight, and in some cases almost inappreciable, as for instance between *Zalophus* and *Neophoca;* the really important differences which sometimes exist between the different groups being unmentioned.

"Section I. *Palate produced behind to a line even with the condyles of the jaws. Grinders* $\frac{6}{5} = \frac{6}{5}$. Sea Lions.

Tribe 1. Otariina.

1. *Otaria.* East and west coast of South America.

Section II. *Palate only extended behind to a line even with the middle part of the zygomatic arch.* Sea Bears.

Tribe 2. Callorhinina. Grinders $\frac{6}{5} = \frac{6}{5}$; skull oblong; face broad, shorter than the orbit; forehead arched.

2. *Callorhinus.* Northwest coast of America.

Tribe 3. Arctocephalina. Grinders $\frac{6}{5} = \frac{6}{5}$; face of the skull shelving in front; the fifth and sixth grinders behind the front of the zygomatic arch.

3. *Phocarctos.* Grinders large, lobed, the six upper with two notches on their hinder edge. South America.

4. *Arctocephalus.* Grinders thick; crown conical. Africa.

5. *Eutaria.* Grinders large, subcylindrical; crown conical; face broad. South America.

6. *Gypsophoca.* Grinders moderate-sized, compressed, with a small, more or less distinct lobe on the front edge of the cingulum; face narrow, compressed. Australia.

Tribe 4. Zalophina. Grinders $\frac{5}{5} = \frac{5}{5}$, large, thick, in a close, continuous series; the fifth upper in front of the back edge of the zygomatic arch.

7. *Zalophus.* Grinders large and thick, in a close uniform series. *South America.* [!]

8. *Neophoca.* Grinders large, thick, all equal, in a continuous uniform series. Australia.

Tribe 5. Eumetopiina. Grinders $\frac{5}{5} = \frac{5}{5}$, more or less far apart; the hinder upper behind the hinder edge of the zygomatic arch, and separated from the other grinders by a concave space.

9. *Eumetopias.* West coast of America.

10. *Arctophoca.* West coast of South America."

ursinus already mentioned, the fangs of several of the molars have a deep longitudinal groove on the outside, the fangs appearing to be formed of two connate roots, but in the corresponding molars of the other specimen there are no grooves, the fangs being wholly simple.

Great variations in the form of the teeth and the bones of the skull have also been pointed out as existing in several species of the *Phocidæ*.* Naturalists are fast becoming aware of the fact that the bones of animals generally are not so invariable in form and proportions as formerly supposed, and hence afford less reliable characters for the discrimination of species than has been generally believed.† Such facts evidently show that too high a value has been placed upon certain relatively slight differences in the form of the teeth and certain parts of the skull.

Color is one of the features commonly much relied on for the distinction of *species* among the higher vertebrates. In the case of the *Otariadæ*, as also happens in other groups, this feature proves to be in no small degree unreliable. In respect to the hair seals, the three or four best known species (*Eumetopias Stelleri*, *Zalophus Gillespii*, *Z. lobatus*, and *Otaria jubata*) so closely resemble each other in color, and different individuals of the same species at the same time vary so much in this regard, that a description of the color of either of the species is almost equally applicable to all. This is equally the case in the fur seals, where sometimes specimens of such really widely distinct species as the *Callorhinus ursinus* and the *Arctocephalus falklandicus* seem hardly distinguishable in color.‡

Habits.

In respect to general habits the eared seals seem to have much in common that distinguishes them from the *Phocidæ*, at least so far as the habits of the latter are known. All the species appear to assemble in

* See especially an important paper by Dr. J. E. Gray, entitled "On the Variations in the Teeth of the Crested Seal, *Cystophora cristata*," etc., Proc. Lond. Zoöl. Soc., 1849, pp. 90–93. Also, by the same author, another entitled "Notes on Seals (*Phocidæ*) and the Changes in the Form of their Lower Jaw during Growth," Ann. and Mag. Nat. Hist., 4th Series, Vol. IV, pp. 342–346, November, 1869.

† See "Mammalia of Massachusetts," Bulletin Mus. Comp. Zoöl., Vol. I, pp. 143–252, October, 1869.

‡ In respect to a skin of *C. ursinus* from California, Dr. Gray has remarked: "The skin is so like that of *Arctocephalus nigrescens* [=*falklandicus*] that we were induced to regard it as a second specimen of that species before we received the skull." (Catalogue of Seals and Whales, p. 52.)

vast numbers at certain favorite places of resort, — usually isolated rocky islands, — for the purpose of reproduction, where they spend several weeks or months, when undisturbed, almost entirely on land. They being eminently polygamous, the old males select their stations and assemble around them a numerous harem, which they guard with the utmost jealousy. Numerous bloody combats ensue between the rival males for the possession of the females, or for favorite stations, and the roaring of the males it is said can be heard for many miles. One young, or at most two, are annually brought forth by each mature female, the period of gestation being about twelve months. Captain Bryant's account * of the habits of the northern fur seal renders unnecessary a detailed account of the habits of any of the species here, especially since the notes added to Captain Bryant's paper sufficiently indicate the similarity of habits which all the species seem to share during the important season of reproduction.

One of the most striking features in their history is that at this period both sexes pass weeks, and even months, without food or without often visiting the water. Arriving at the breeding-grounds exceedingly fat and unwieldy, they seem to be sustained by the fat of their bodies, they finally leaving at the end of the breeding-season greatly emaciated.

A similar fact has been long known in respect to the walrus, whose period of fasting, however, seems to be shorter than that of the eared seals.

In respect to breeding habits, the sea elephant (*Macrorhinus elephantinus*) is the sole species of the earless seals which seems to quite closely resemble the *Otariadæ*. They assemble in a similar manner at their breeding-grounds, and pass much of their time during the reproductive period on the land, and probably without taking food; but the accounts of travellers are on this point somewhat contradictory. It does not appear, however, that they are to so great a degree polygamous. And they move on the land with great difficulty, and go but a short distance from the water.

Of the Genera and Species.

Of the Genera. — The genus *Otaria* was, as previously stated, proposed to embrace all the eared seals as a group distinct from the earless seals, for which the name *Phoca* was retained. But naturalists have found it necessary, as our knowledge of these animals has increased, to

* See Part II, beyond.

greatly subdivide each of these groups. *Otaria* is now restricted to a single species; while the original *Otaria* (=*Otariadæ*), as defined by Péron, has been separated into ten groups to which generic rank has been accorded; none of them containing more than a single species.

The first division of the *Otariæ* was made by F. Cuvier* in 1825, who separated them into two genera, *Platyrhynchus* and *Arctocephalus*, with the *O. jubata* of recent systematists as the type of the former, and *Arctocephalus Delalandii* (*antarcticus*) as the type of the latter. Dr. Gray,† in 1859, separated generically the Northern fur seal from *Arctocephalus*, under the name of *Callorhinus*.

The next subdivision of the group was made by Dr. Gill,‡ in 1866, who in his "Prodrome of a Monograph of the Pinnipedes," separated them into five genera.§ These appear to be natural groups, of true generic rank, and properly restricted; and, after a careful examination of the subject, and specimens of four of these five types, they appear to me to include all the natural genera of the family. As has been previously pointed out by Gray and Peters,‖ Dr. Gill, as he himself now freely admits, wrongly retained the name *Arctocephalus* for Gray's genus *Callorhinus*, and consequently substituted *Halarctus* for what had previously been regarded as *Arctocephalus*. Two of these genera (*Eumetopias* and *Callorhinus*) include but a single known species each; *Otaria* has possibly two, *Zalophus* two, and *Arctocephalus*, according to the views of different writers, three or four.

Professor Peters,¶ in 1866, divided *Otaria* into seven sections or subgenera, he adding two (*Phocarctos*, type *Otaria Hookeri*, and *Arctophoca*, type *Otaria Philippii*, a nominal species, = *Arctocephalus falklandicus*) to the number of divisions recognized by Gill. The principal character on which the latter (*Arctophoca*) was first founded proved to be an invalid one,** yet it was subsequently transferred by Peters, with a slight modification of its diagnosis, to the *Arctocephalus falklandicus*.

* Mém. du Mus., Vol. XI, p. 205. † Proc. Lond. Zoöl. Soc., 1859, p. 359.

‡ Proc. Essex Institute, Vol. V, p. 7.

§ *Otaria*, type *Phoca jubata* Schreber; *Arctocephalus*, type *Phoca ursina* Linné; *Eumetopias*, type *Otaria californiana* Lesson, = *Arctocephalus monteriensis* Gray; *Zalophus*, type *Otaria Gillespii* McBain; *Halarctus*, type *Arctocephalus Delalandi* Gray.

‖ See above, p. 7 of the "Résumé." ¶ Monatsb. Akad. Berlin, 1866, pp. 261, 665.

** The number of molars of *A. Philippii* was supposed to be $\frac{5}{5} = \frac{5}{5}$ instead of $\frac{6}{5} = \frac{6}{5}$, as in the other fur seals, but the skull figured and described by Peters as that of this species had evidently lost the fifth (last but one) pair of molars, as shown by his figure of the skull. Peters himself afterwards referred his *A. Philippii* to the *A. falklandicus*.

Dr. Gray, in his various papers published since the appearance of Professor Peters's papers, has not only recognized as genera all the genera and subgenera previously proposed by Gill and Peters, including *Arctophoca*, with essentially Professor Peters's *first* diagnosis of it (including the dental formula!), but has added three others (*Euotaria*, *Gypsophoca*, and *Neophoca*). Taking into account the nature of the diagnostic characters of his pseudo-genera given in his last synopsis of the family,* his classification is too palpably arbitrary to require a detailed review.

Of the Species. — For a long period the northern sea lions were by most writers regarded as specifically identical with the southern sea lions, and the northern sea bears with the southern sea bears. Peron in 1816 first called attention to the fact that the northern and southern sea lions and sea bears were distinct species. During the following twenty-five years many naturalists of high authority still regarded them as identical, whilst others considered them as distinct. In 1840 they were for the last time seriously confounded; but until within the last four years the two species of *Zalophus*, the one northern and the other southern, have been regarded as one. It is now generally believed, however, that in no case is the same species found on both sides of the equator.† In Péron's time there were commonly believed to be but a single species of sea lion and a single species of sea bear. He however affirmed that as many as twenty species of sea bears alone were confounded under that name. Since that time many nominal species have been described, — doubtless partly in consequence of Peron's remark, — until the number of distinct names applied to the different sea lions and sea bears exceeds fifty, while probably the number of veritable species is not more than ten. This, in fact, is the number now most commonly recognized. In consequence of the early confounding of the northern with the southern species, an extraordinary complication of synonymy has resulted, several of the earlier names having been applied by different writers to several different species. The synonomy of some of these species hence embraces a list of ten to fifteen different and variously applied names.

Of the hair seals, four apparently unquestionable species are now well

* Ann. and Mag. Nat. Hist., 4th Series, Vol. IV, p. 269. This synopsis has already been quoted in full on p. 35.

† See further remarks on this point below, under the head of "Geographical Distribution."

known, two of which (*Eumetopias Stelleri* and *Zalophus Gillespii*) are northern, and two (*Otaria jubata* and *Zalophus lobatus**) are southern. A fifth species (*Otaria Hookeri*), also southern, is likewise commonly recognized. But it appears to be known only from specimens in the British Museum,† collected many years since at the Falkland Islands, and does not seem to have been met with by recent collectors, either at the Falklands or elsewhere. It differs from the *O. jubata*, judging from the figures and the not wholly satisfactory descriptions we have of it, mainly in having the palatal bones less produced posteriorly; at least this is the difference that has been chiefly dwelt on as distinguishing the two, although certain differences in the color of the under-side of the body have also been mentioned. The skull figured by Gray is evidently that of a middle-aged or rather young animal. The form of the bony palate corresponds also with what is seen in middle-aged and young specimens of other hair seals. Having seen apparently as great differences in specimens of the northern species, unquestionably specifically identical, as exists between *O. jubata* and *O. Hookeri*, I am led to question whether the specimens described as *Otaria* [*Phocarctos*] *Hookeri* may not be an unusual state of *Otaria jubata*, the only hair seal now known to exist in the Falkland Islands; the difference resulting partly from age and partly from abnormal development. Not having seen specimens of the *O. Hookeri*, I do not presume to assume it to be referable to *O. jubata;* my design by this reference is mainly to call attention to its somewhat doubtful character.

Two genera of fur seals are also commonly recognized. One of these genera consists of the *Callorhinus ursinus*, or the fur seal of the North. The other genus embraces numerous nominal species, all but one of which have been referred by Peters, and also by Gray in his later papers, to three species, all of which have a southern distribution.

* Péron, under the name *Otaria cinerea* (Voy. aux Terr. austr., Tome II, pp. 54, 77), undoubtedly referred to the so-called *Zalophus lobatus* of recent writers. Although his description is rather meagre, the size given, as well as the character of the hair, and especially the context (at p. 77), render it clear that he must have intended to indicate by this name the species more fully described later by other writers. Péron's name was at first used by Gray to designate what he has since called *lobatus*. Although there is little reason to doubt that Péron's earlier name of *cinerea* refers to this species, it is perhaps not advisable to substitute for a well-established name one of possibly doubtful application.

† See Catalogues of the British Museum (Seals, 1850, p. 45; Seals and Whales, 1866, p. 51; Bones of Mammalia, p. 146, etc.).

These are, *Arctocephalus falklandicus*, — one of the earliest described species of the family, — *A. cinereus* and *A. antarcticus* (= *A. Delalandi*). *A. falklandicus* inhabits the shores and islands of Southern South America; *A. cinereus*, the Australasian Seas; and *A. antarcticus*, the southern coasts of Africa. These species hence have quite widely separated habitats, yet the alleged differences between them are slight, while in size, color, character of the pelage, and general conformation, they possess many features in common. Their distinctness has at times been doubted, and it seems still to remain an open question whether they form a single species or three. That the *A. falklandicus* and *A. antarcticus* hold a close relationship is generally admitted. The *A. cinereus*, or the Australian species, was believed, through certain differences in the fangs of the hinder molars, and the supposed less abundance of the under-fur, to be quite distinct from the others. Professor Peters, in his second paper, placed the *A. cinereus* and *A. antarcticus* in different subsections of his section *Arctocephalus*, characterizing them as follows: "*a.* mit sehr sparsamer Unterwolle" (referring to *A. antarcticus* = *Otaria pusilla* Peters), and "*β.* mit reichlicherer Unterwolle" (referring to *A. cinereus*). It is found, however, that the fur of the latter is equally rich with that of the other species.*

The distribution of these alleged species presents nothing incompatible with the supposition of their identity. They inhabit islands one third as distant from the shores of the South American, African, and Australian continents as these islands are from each other. Other Pinnipedes, as the sea elephant, range over nearly the same area. Moreover, the distance is one of longitude merely, and the physical conditions of this wide area are hence nearly uniform. Until favored with the opportunity of comparing specimens from these several distant points, my opinion as to the identity or diversity of these species must remain unsettled.

In respect to the synonomy of the eared seals, that of the northern species will be presently given in full, in connection with the descriptions of these species. To that of *Otaria jubata*, given so fully by Dr. Gray in his first memoir on these animals, may be added, as clearly shown already by other writers,† the following recently recognized names:

* Ann. and Mag. Nat. Hist., 3d Series, Vol. XVIII, p. 257, 1866.

† For references to the papers wherein the following-named synonymes occur, see the "Résumé of the recent Contributions to the Natural History of the *Otariadæ*," *antea*, pp. 4–19.

Otaria Byronia, *O. leonina*, *O. Godeffroyi* and *O. Ulloæ* of Peters, to which should be added the "*O. Ulloæ?*" McBain (= *O. Graii* Günther), the *O. leonina* Maack, and probably also the *O. Hookeri* of Gray.

To the synonomy of *Arctocephalus falklandicus*, given by Professor Peters, the *O.* [*Arctophoca*] *Philippii* Peters and Gray.

To that of the *A. antarcticus* — (= *Otaria pusilla* Peters, = *Arctocephalus Delalandi* Gray) — given by Professor Peters and in Dr. Gray's above-cited catalogues, *A. nivosus* and *A. schisthyperoës* Turner (= *A. schistuperus* Günther).

To the synonymes of *A. australis* may doubtless be added the *A. Forsteri* Gray.

Geographical Distribution. — As long since announced by Péron, the Pinnipedes have their habitats as definitely circumscribed as do the land mammalia. Previously, as already stated, the northern sea lions and sea bears were popularly regarded as specifically identical with the southern sea lions and sea bears; and even as late as 1840 Nilsson entertained the error regarding their identity so universally made by the early writers. It has been found, however, that in only one instance can the species living north and south of the equator be regarded as referable to even the same genus. In this case the species living north of the equator (*Zalophus Gillespii*) ranges the furthest to the southward of the northern species, while its congener living south of the equator ranges furthest to the north of any of the southern species. The habitat of no species, so far as certainly known, quite reaches the tropics.*

The eared seals hence occupy two distinct areas, separated by the broad expanse of the tropical waters. Furthermore, and what is most singular in their distribution, none, as is well known, exist on the shores of the North Atlantic. South of the equator they occupy a broad circumpolar belt, extending from near the tropics to the region of antarctic ice. Here also they reach their greatest numerical development in respect to the number of species; for while three species only are known from the northern waters, at least seven are commonly reckoned as inhabiting the southern waters. As previously remarked, however, this number is probably much too large.

* There is a skull of *Otaria jubata* in the Anatomical Museum of Harvard University, labelled as having come from "Arica, Peru," but I think it doubtful if it was collected at that point.

In respect to genera, the number existing in the northern and southern waters is equal; there being two of hair seals and one of fur seals at the north, and the same number at the south. One genus, *Zalophus*, is found both at the North and South. *Eumetopias* of the North may be regarded as represented at the South by *Otaria;* and *Callorhinus* of the North by *Arctocephalus* at the South. *Callorhinus* and *Arctocephalus* are undoubtedly representative groups; but if we regard the latter as composed of three intimately related species instead of one, we shall have three species of fur seals at the South against one at the North. *Zalophus* is the most southern genus, its single species on each side of the equator nearly reaching the tropics, if not actually existing within them at Moluccas, as represented by Mr. Murray* in his map of the distribution of these animals. Another interesting fact is that on the coast of Asia the northern species of *Zalophus* (*Z. Gillespii*) is well known to inhabit Japan, whilst the home of the southern species (*Z. lobatus*) includes the shores of Australia and the neighboring islands; so that the only two congeneric species of the eared seals distributed on opposite sides of the equator are those whose habitats most nearly approach each other. The distribution of the species is further indicated in the following conspectus, which is designed to give a concise view of the different groups of the eared seals, with their principal distinctive characters, affinities, and the geographical distribution of the species.†

* Geographical Distribution of Mammals, Map XXVIII, 1866.

† The following observations respecting the distribution of the eared seals of the eastern coast of South America have been kindly communicated to me by Dr. G. A. Maack, who in November and December, 1867, visited the coast of Buenos Ayres for the purpose of obtaining specimens of these animals: —

"The eared seals, of the eastern coast of South America, exist especially between the 34th and 40th degrees of south latitude. North of the Rio de la Plata they occur at the Islas de los Lobos, near Maldonado. South of this river they occur in great numbers at the Cabo Corrientes, where they frequent the rocks at the base of the vertical and even overhanging cliffs (160 to 170 feet high) of these shores. I visited the latter locality during the months of November and December, 1867, where I had the opportunity of observing these animals alive. But as Professor Burmeister and myself have already published the scientific results of this excursions [see above pp. 13 and 18], but little requires to be added here.

"As stated in my paper in 'Der Zoologische Garten' (Jan., 1870), only two species of these animals exist on the eastern coast of South America: one, the *Otaria jubata*, from its having but a single kind of hair, is known to the natives as the *Lobo marino con uno pelo;* and the other, *Arctocephalus falklandicus*, from having both external hair and under-fur, is called the *Lobo marino con dos pelos.* Of both I obtained specimens. The

Conspectus of the Genera and Species.

Subfamily I. — TRICHOPHOCINÆ.

Without under-fur. Size large and form robust. Ears short and broad. Molars either $\frac{6}{5} = \frac{6}{5} = \frac{1\,2}{1\,0}$ or $\frac{5}{5} = \frac{5}{5} = \frac{1\,0}{1\,0}$.

I. *Genus* Otaria *Gill ex Péron.*

Palatines usually extending nearly to the pterygoid processes (sometimes reaching them and sometimes terminating considerably anterior to them); their posterior margin generally nearly straight. Molars $\frac{6}{5} = \frac{6}{5} = \frac{1\,2}{1\,0}$.

1. *Otaria jubata* Blainv.* Habitat: Coasts and islands of South America, from Chili, (Arica, Peru?) on the west, and the Rio de la Plata southward to the Antarctic Islands.

II. *Genus* Eumetopias *Gill.*

Palatines much less produced posteriorly than in *Otaria*. Molars $\frac{5}{5} = \frac{5}{5} = \frac{1\,0}{1\,0}$.

2. *Eumetopias Stelleri* Peters. Habitat: Coasts and islands of the North Pacific, from California and Southern Kamtchatka northward.

III. *Genus* Zalophus *Gill.*

3. *Zalophus Gillespii* Gill. Habitat: Coasts and islands of the North Pacific, from Lower California and Southern Japan northward.

4. *Zalophus lobatus* Peters. Habitat: Australasian Seas, especially the shores of Australia and New Holland.

Subfamily II. — OULOPHOCINÆ.

With thick under-fur. Size smaller; form more slender, and the ears, and the toe-flaps of the hinder limbs, much longer than in *Trichophocinæ*. Molars $\frac{6}{5} = \frac{6}{5} = \frac{1\,2}{1\,0}$.

IV. *Genus* Callorhinus *Gray.*

5. *Callorhinus ursinus* Gray. Habitat: The continental coasts and islands of the North Pacific, from California and Southern (?) Kamtchatka northward.

males and females of *Otaria jubata* are both abundant at the Cabo Corrientes, where in the month of December they bring forth their young; but of the *Arctocephalus* I observed only males. The females of the latter are entirely unknown at this point, this species probably repairing to other localities to breed. One of the native gauchos informed me that, during the fifteen years he had been accustomed to kill them here, he had never met with a female."

* Including *Otaria Hookeri* Gray et auct.

V. *Genus* ARCTOCEPHALUS *F. Cuvier.*

6. *Arctocephalus falklandicus* Gray. Habitat: Coasts and islands of South America, from Chili on the west and the Rio de la Plata southward to the Antarctic Islands.

? 7. *Arctocephalus cinereus* * Gray. Habitat: Southern shores of Australia and New Zealand and the islands to the southward.

? 8. *Arctocephalus antarcticus* * Gray. Habitat: Southern coast of Africa and the adjoining islands.

3. *On the North Pacific Species of* OTARIADÆ.

SUBFAMILY I. — TRICHOPHOCINÆ.

Without under-fur. Size large and form robust. Ears short. Molars either $\frac{6}{6} = \frac{6}{6} = \frac{1\,2}{1\,0}$, or $\frac{5}{5} = \frac{5}{5} = \frac{1\,0}{1\,0}$.

Genus EUMETOPIAS Gill.

Eumetopias GILL, Proc. Essex Institute, V, 7, 11. July, 1866. Type "*Otaria californiana* Lesson, = *Arctocephalus monteriensis* Gray."

Molars $\frac{5}{5} = \frac{5}{5} = \frac{1\,0}{1\,0}$; the upper hinder pair separated from the others by a considerable interval; the last only double rooted. Postorbital processes quadrate. Palatine surface of the intermaxillaries flat, only slightly depressed, and greatly contracted posteriorly; the palatals moderately produced, extending about three fourths of the distance from the anterior end of the zygomatic arch to the pterygoid process; their posterior margin straight, or slightly or deeply emarginate; rarely deeply so in old age.

Eumetopias hence differs from *Otaria*, as restricted by Gill, in having one pair less of upper molars,† a much less posterior extension of the palatine bones, and in having the posterior portion of the surface of the intermaxillaries less than one third, instead of more than one half, the width of the anterior portion, and but slightly instead of deeply depressed; also in the form of the postorbital processes, which in *Eumetopias* are quadrate, while in *Otaria* they form an obtuse, nearly equilateral triangle, the apex of which points outward. In *Otaria* they are also more produced. In the general character of the pelage, in color, in proportions and size, there seems to be a close resemblance

* Perhaps the *A. cinereus* and the *A. antarcticus* are to be referred to the *A. falklandicus*, in which case the habitat of this species is the southern seas generally.

† See the characters of *Otaria* given in the preceding "Conspectus," p. 43.

between the single known species of *Eumetopias* (*E. Stelleri*) and the single known species of *Otaria* (*O. jubata*).

Eumetopias differs from *Zalophus* through the presence of a wide space between the fourth and fifth pairs of upper molars, the less emargination of the posterior border of the palatine bones, the quadrate instead of the triangular and posteriorly pointed form of the postorbital processes, the less relative breadth of the posterior nares, and the larger size of the facial angle; also through its much broader muzzle, the less degree of the postorbital constriction of the skull, and its much less developed sagittal crest. It differs from *Neophoca* Gray, as nearly as can be determined from the published figures and defective descriptions, in nearly the same manner.

Eumetopias Stelleri *Peters.* Steller's Sea Lion.

Leo marinus Steller, Nov. Comm. Petrop., XI, 360, 1751.
"*Phoca jubata* Schreber, Saugeth., 300, lxxxiii, 1775 (in part only; not *P. jubata* Forster)."
Phoca jubata Gmelin, Syst. Nat., I, 63, 1788 (in part).
" " Pander and D'Alton, Skelete der Robben und Lamant., Pl. III, Figs. d, e, f, 1826.
Otaria jubata Péron, Voyage Terr. austr., II, 40, 1816.
" " Nilsson, Arch. f. Naturgesch., 1841, 329 (in part only).
Otaria Stelleri Lesson, Dict. Class. Hist. Nat., XIII, 420, 1828.
Phoca Stelleri Fischer, Synop. Mam., 231, 1829.
Otaria Stelleri J. Muller, Arch. f. Naturgesch., 1841, 330, 333.
" " Gray, Cat. Seals in Brit. Mus., 47, 1850.
" " Sclater, Proc. Zoöl. Soc., 1868, 190.
" " Gray, Cat. Seals and Whales in Brit. Mus., 60, 1866.
Otaria (*Eumetopias*) *Stelleri* Peters, Monatsb. Akad. Berlin, 1866, 274, 671.
Eumetopias Stelleri Gray, Ann. and Mag. Nat. Hist., 3d Ser., XVIII, 233.
Otaria californiana Lesson, Dict. Class. Hist. Nat., XIII, 420, 1828.
Phoca californiana Fischer, Synop. Mam., 231, 1829.
Eumetopias californianus Gill, Proc. Essex Inst., V, 13, July, 1866.
Arctocephalus monteriensis Gray, Proc. Zoöl. Soc., 1859, 360, Pl. lxxii (in part).*
Le Lion marin Buffon, Hist. Nat., Suppl., VI, 337, 1782 (in part).
Leonine Seal Pennant, Arctic Zoölogy, I, 200 (in part).

Color. — General color of the upper side of the body varying from pale yellowish brown to reddish brown; much darker towards the tail, and not

* Excluding the skin (and young skull?), here doubtfully referred to *A. monteriensis*, and afterwards described by the same author as *A. californianus*, in Cat. Seals and Whales, p. 51 (1866).

unfrequently marked on the back and sides with irregular-shaped dark brown patches. The sides below the median line are reddish, shading above into the lighter color of the back, and below into the darker color of the lower surface. Lower side of the body dusky reddish-brown, darkest on the hinder portion of the abdomen. Limbs dark reddish-brown, approaching black, especially externally.

While the general aspect of the color is as above indicated, the hairs individually greatly vary in color. While some are entirely pale yellowish, others are yellowish only at the tip, and dark below, and others are dark reddish-brown or nearly black throughout. The mixture of these two colors gives a brindled appearance on some parts of the body, and to a much greater extent in some specimens than in others. The relative proportion of the light and dark hairs determine the general color of the different regions of the body.

The color appears to vary much in different individuals, not only with age and sex, but irrespective of sex and age.

Hair. — The hair is of two kinds, the outer of which is straight, coarse, stiff, and flattened. Beneath this is an exceedingly sparse, very short, finer under-coat, so short and in such small quantity as to be detected only with difficulty. The hair is longest on the anterior half of the body, where it has an average length of 40 mm.; it decreases in length posteriorly, and towards the tail has an average length of only 15 mm. It is still shorter on the abdomen, whilst on the limbs it is much more reduced, and disappears entirely towards the ends of the digits. The end of the nose, the soles and palms, the anal region, and the extra-digital cartilaginous flaps are naked and black. The whiskers are long, slender, and cylindrical, white or brownish-white, and set in four or five rather indistinct rows. Some of the longest sometimes reach a length of 50 cent., or about twenty inches, with a maximum thickness of 2 mm.

Size. — The length of full-grown males is about twelve or thirteen feet. According to Captain Bryant they frequently reach the latter size, and a weight of from fifteen to eighteen hundred pounds. The females, he observes, are much more slender than the males, and do not attain to more than one fourth the weight of the latter.

Ears. — The ears (Fig. 8, Pl. I) are short and pointed, but much broader than those of the Northern fur seal (Fig. 13, Pl. II), though of only half their length.

Hind Limbs. — The hind feet (Fig. 7, Pl. I, $\frac{1}{20}$ nat. size) are broad and, gradually widening from the tarsus, reach their greatest breadth at the end of the toes. Their length is short as compared to their breadth, the distance between the ends of the outer toes when spread nearly equalling the whole length of the foot. The toes are terminated with strong

cartilaginous flaps, covered with a thick leathery naked membrane, which is deeply indented opposite the intervals between the toes, and serves to connect the rather diverging digits. The three middle toes are provided with long, well-developed nails; the outer toes are without true nails, but in place of them are thickened, horny disks, which may be regarded as rudimentary nails, which an examination of the skeleton shows them to be. The outer toes are slightly shorter than the three middle ones, which are sub-equal.

Fore Limbs. — The fore feet (Fig. 6, Pl. I, $\frac{1}{2\,0}$ nat. size) are large, triangular, and situated but a little in front of the middle of the body. They terminate in a thick, hard, membranous flap, which is slightly and somewhat irregularly indented on the inner side. The terminations of the digits are indicated by small circular horny disks or rudimentary nails.

Measurements. — The following table of external measurements of two males, one very aged and the other mature, indicates the general proportions of the body. A part were taken from the moist skins before stuffing, and the others from the same skins mounted.

Measurements of Two Skins of EUMETOPIAS STELLERI.

	No. 2920. ♂ 10 years old.		No. 2921. ♂ 15 years old.	
	Unmounted.	Mounted.	Unmounted.	Mounted.
Length of body	2,750	2,790	2,896	3,010
" " tail	100	100	—	110
Extent of outstretched fore limbs	2,362	—	—	—
Length of hand	575	560	635	620
Breadth " "	337	335	—	360
Length " foot	559	540	—	610
Breadth " " at tarsus	216	210	—	230
" " " " ends of the toe-flaps	483	445	—	440
Length of flaps of outer toe	200	200	—	220
" " " " 2d toe	179	156	—	210
" " " " 3d toe	152	147	—	190
" " " " 4th toe	164	150	—	190
" " " " inner toe	164	150	—	165
Distance from end of nose to eye	215	190	—	170
" " " " ear	368	365	—	380
" between the eyes	190	195	—	210
" " " ears	372	370	—	420
Length of the ear	37	35	—	35
" " longest barbule	342	342	—	—
Dist between points of longest barbules	800	800	—	—
Circumference of the body at fore limbs	—	2,250	—	2,600
" " " near the tail	—	1,000	—	1,020
" " head at the ears	—	1,000	—	980
Length of body to end of hind limbs		3,450		3,790

Skull. — The skull (Figs. 3 and 4, woodcuts, pp. 57–58, and Figs. 1–4, Pl. I) varies greatly in different individuals, not only in its general form, but in the shape of its different bones. The occipital and median crests are doubtless not much developed before the fifth or sixth year. The bones thicken greatly after the animal attains maturity, and the palate becomes more flattened. In the adult male the brain-box may be described as subquadrate, narrower anteriorly, where the skull is abruptly contracted. The greatest diameter of the skull is at the posterior end of the zygoma, and is equal to three fifths of its length. The post-orbital processes are strongly developed and quadrate; the forehead is flat, and the facial profile is either abruptly or gradually declined; the muzzle is broad, equal in breadth in front to the distance between the orbits. The palatal surface of the intermaxillaries is flat, or slightly depressed anteriorly, and very slightly contracted posteriorly. Laterally the intermaxillaries reach nearly to the end of the palatals. The latter are much contracted posteriorly, and terminate quite far in front of the hamuli pterygoidii. Both the anterior and posterior nares are a little narrower than high. The nasals are widest anteriorly. The last (fifth) pair of upper molars is placed far behind the fourth pair, the space between them being about equal to that occupied by two molars. The males in old age have exceedingly high occipital and sagittal crests, most developed posteriorly; anteriorly they diverge and terminate in the hinder edge of the postorbital processes.

The lower jaw is massive and strong. Its coronoid processes are greatly developed, as are the tuberosities at the angles of the rami, and a second tuberosity on the lower inner edge of each ramus (see Figs. 9–11, Pl. III).

It should be added that the above description of the skull refers exclusively to the male. Having no skulls of the female, I am unable to state definitely how the sexes differ in respect to the form of the skull. Judging, however, from the sexual variations seen in *Callorhinus ursinus*, *Otaria jubata*, and other species of the *Otariadæ*, the skull of the female would be not only very much smaller, but it would lack almost totally the high occipital and sagittal crests exhibited by the male, and have all the processes for the attachment of muscles less developed. The teeth, especially the canines, are relatively much smaller, as is also the lower jaw. In other words, the female skull would doubtless closely resemble the skull of a yearling male. The annexed table of measurements indicates still further the general form of the male skull and the relative proportions of its different regions.

Measurements of the Skull.

	No. 2920. Middle aged. ♂	No. 2921. Very old. ♂
Length	374	385
Breadth	220	246
Dist. from ant. edge of intermaxillary to hamuli pterygoidii	243	247
" " " " to last molar (left side)	160	160
" " " " " " (right side)	160	150
" " " " to ant. edge of zygm. arch	140	140
" " " " post. " "	246	250
" " " " to auditory orifice	290	300
Length of left palatine bone (inner edge)	50	64
" " " " " (outer edge)	55	68
" " right " " (inner edge)	45	63
" " " " " (outer edge)	49	63
Breadth of right palatine anteriorly	16	19
" left " "	19	21
" right " posteriorly	12	16
" left " "	13	18
Distance from edge of palatals to ptyg. process	48	46
" " " last molar to post. edge of palatals (left side)	32	42
Depression of palate below alveoli of canines	19	17
" " " " 2d and 3d molars	41	38
" " " " 4th molar	18	20
Length of the nasals (outer edge)	60	64
" " " (inner edge)	47	48
Breadth of nasals (anteriorly)	32	38
" " " (posteriorly)	45	44
" of the skull at the canines	95	110
" " " postorbital processes	120	130
" " " paroccipital "	200	235
" " anterior nares (vertical)	54	54
" " " " (transverse)	48	55
" " posterior nares (vertical)	32	42
" " " " (transverse)	30	36
Length of zygomatic foramen	116	120
Breadth " "	80	80
Diameter of foramen magnum (transverse)	30	33
" " " " (antero-posterior)	33	36
Greatest height of skull (paroc. proc. to top of occip. crest)	145	165
Distance from lower edge of condyles " " "	132	140
Height of skull from hamuli pteryg. to top of sagittal crest	150	160
Length of sagittal crest	80	180
Greatest height of skull	38	35
Length of lower jaw	270	280
Breadth of the lower jaw at the condyles	185	210
" " " " last molar	100	110
" " " in front	65	65
" " condyle	60	60
Height of lower jaw at the coronoid process	85	95
" " " at symphysis	65	75

Teeth. — Last upper molar is double-rooted, and its crown directed backwards. All the other molars are single-rooted, with a slight median longitudinal groove on the outside. Their crowns are irregularly conical, pointed, and jut out over their contracted necks; inner side of the crowns hollowed. Surface of the crowns roughened with minute, longitudinal grooves and ridges. The upper molars have no trace of the supplemental points to the crowns seen in many species of this family. The lower molars, particularly the third and fourth, have very slight accessory cusps. Necks of the molars uniform in size with the upper part of the fangs. Fangs of the molars gradually tapering, those of the first and second upper much curved inwards; that of the third less so; that of the fourth straight; the two fangs of the fifth are directed abruptly forward, the posterior one much the smaller. Canines of both jaws very large, the upper, however, much the larger; the lower more curved. Of the six incisors of the upper jaw, those of the outer pair are much larger than the middle ones, two thirds as long as the canines, and much like them in form. The middle ones have their antero-posterior diameter nearly twice their lateral diameter, and their crowns are divided transversely. The fangs of the inner pair are slightly bifid. Of the four lower incisors the outer are much the longer. Figures 5–5 *e* (one half natural size), Plate I, shows the form of the teeth, and the subjoined table their size.*

Measurements of the Teeth.

A. — Teeth of the Upper Jaw.

	Molars.					Canines.	Incisors.		
	5th.	4th.	3d.	2d.	1st.		Outer.	Middle.	Inner.
Total length . . .	27	33	36	37	40	84	63	29	25
Length of the crown .	9	13	13	13	11	34	23	5	4
" " neck † .	6	6	6	6	6	6	7	7	7
" " root ‡ .	12	14	15	18	23	—	—	—	—
Antero posterior diameter §	11.5	13	13	13	11.5	24	15	7	6
Lateral diameter § .	6.5	9	10	10	8.5	20	12	5	4

* These figures and dimensions (the latter given in millimetres) are taken from the younger or middle-aged specimen, in which the dentition was perfect and normal. In old age many of the teeth are usually broken, and a portion of them often entirely wanting, through loss from accident. As the lower canines could not be removed without removing a portion of the jaw, they have not been figured nor fully measured.

† The distance from the crown to the alveolus.

‡ The portion of the tooth inserted in the jaw.

§ At the base of the crown.

B — Teeth of the Lower Jaw.

	Molars.					Canines.	Incisors.	
	5th.	4th.	3d.	2d.	1st.		Outer.	Inner.
Total length	28	42	42	39	30	—	31	25
Length of the crown	10	12	14	12	10	35	8	5
" " neck*	5	5	5	5	5	7	4	4
" " root†	13	25	23	22	15	—	19	16
Antero-posterior diameter†	9	13	15	12.5	10.5	26	7	6
Lateral diameter‡	6	9	10	9	8.5	17	9	5

Skeleton. — Vertebral formula: Cervical vertebræ, 7; dorsal, 15; lumbar, 5; caudal (including the four sacral), variable; probable average, 16.

Ten of the fifteen ribs articulate with the sternum; their sternal portions are entirely cartilaginous. Their osseous portions evidently increase much in length after middle age. The apophyses of the vertebræ are well developed. Of the neural spines of the dorsal vertebræ, the first, second, and third are sub-equal, 130 mm. long; they gradually shorten posteriorly, the last having a length of only 75 mm.

The sternum is normally composed of nine osseous thick and broad segments, the first and last very long, the eighth shortest. Between the eighth and ninth a shorter cartilaginous one is sometimes intercalated (as in specimen No. 2920).

The pelvis (already fully described on pages 27 – 29) is well developed. The ilia are very long and narrow antero-posteriorly. The pubic bones are unanchylosed, they being merely approximate at their posterior extremities. Probably in the females (as in *Callorhinus ursinus*), they are widely separated, and the whole pelvis much smaller than in the males and differently shaped.

The humeri, as in the other Pinnipedes, are short and thick, with the greater tuberosity enormously developed. The bones of the fore-arm are also very large and strong, with all their processes greatly developed; in length they but slightly exceed the humerus. The length of neither of the segments of the arm quite equals the length of the bones of the first digit (including its metacarpal bone) of the hand. The first digit of the hand is the longest, twice as long as the fifth, and very thick and strong.

The bones of the hinder limbs are also short and thick, especially the femur, which is scarcely more than one third as long as the tibia. The latter in length about equals the foot. The relative length of the digits

* The distance from the crown to the alveolus.

† The portion inserted in the jaw.

‡ At the base of the crown.

is as follows, the longest being mentioned first: 5th, 1st, 2d, 3d, and 4th. The third and fourth are of equal length, and but little shorter than the second. In respect to size, the tarsal and phalangeal bones of the fifth digit are nearly twice as large as those of the first, whilst those of the first are about twice the size of those of either of the other three. As previously noticed, the three middle digits of the foot are supplied with long narrow nails; the first and fifth with rudimentary ones, scarcely visible in the skin but quite distinct in the skeleton.

Measurements of the Bones of the Hand (metacarpal and phalangeal).

	Middle-aged Specimen.					Very old Specimen.				
	1st digit.	2d digit.	3d digit.	4th digit.	5th digit.	1st digit.	2d digit.	3d digit.	4th digit.	5th digit.
Length of metacarpal and phalanges . . .	352	310	240	200	177	357	320	250	205	185
Length of metacarpal bone	152	110	85	80	80	160	110	90	80	85
" " 1st phalanx .	140	95	70	55	65	140	95	70	60	65
" " 2d " .	60	80	60	45	20	57	80	65	45	18
" " 3d " .	—	25	25	20	12	—	35	25	20	17

Measurements of the Bones of the Foot (metatarsal and phalangeal).

	Middle-aged Specimen.					Very old Specimen.				
	1st digit.	2d digit.	3d digit.	4th digit.	5th digit.	1st digit.	2d digit.	3d digit.	4th digit.	5th digit.
Length of metatarsal and phalanges . . .	310	290	290	305	328	320	317	327	350	350
Length of metatarsal bone	120	95	95	110	130	145	110	110	120	130
" " 1st phalanx .	140	90	90	90	93	130	100	105	105	110
" " 2d " .	50	75	75	80	70	45	80	85	95	75
" " 3d " .	—	30	30	25	35	—	27	27	30	35
" " nail . .	—	40	40	37	—	—	50	55	50	—

The hyoid bone is greatly developed. Each ramus consists of five segments, its two rami being connected together by a transverse segment articulating with the juncture of the fourth and fifth segments. All the parts of the hyoid bone are very thick, especially the transverse and anterior segments; relatively much more so than in *Callorhinus*. In the common *Phoca* the hyoid bone is reduced almost to a bony filament. The length of the hyoid bone in the present species is 270 mm.; of the transverse segment, 65 mm.; circumference of the transverse segment, 45 mm.; of the segment at the thickest part, 95.

Measurements of the Skeleton.

	No. 2920. ♂ 10 y'rs old.	No. 2921. ♂ 15 y'rs old.
Whole length of skeleton (including skull)	2,750	2,935
Length of skull	374	385
" " cervical vertebræ	500	540
" " dorsal "	1,050	1,090
" " lumbar "	340	400
" " caudal "	440	520
" " first rib	260	224
" " " osseous portion	130	140
" " " cartilaginous portion	130	100
" " second rib	345	295
" " " osseous portion	175	185
" " " cartilaginous portion	170	120
" " third rib	410	410
" " " osseous portion	230	270
" " " cartilaginous portion	180	140
" " fourth rib	470	470
" " " osseous portion	280	330
" " " cartilaginous portion	190	140
" " fifth rib	535	530
" " " osseous portion	320	370
" " " cartilaginous portion	215	160
" " sixth rib	580	590
" " " osseous portion	360	420
" " " cartilaginous portion	220	170
" " seventh rib	640	620
" " " osseous portion	400	440
" " " cartilaginous portion	240	180
" " eighth rib	670	670
" " " osseous portion	420	480
" " " cartilaginous portion	250	190
" " ninth rib	710	685
" " " osseous portion	420	485
" " " cartilaginous portion	290	200
" " tenth rib	750	745
" " " osseous portion	420	485
" " " cartilaginous portion	330	260
" " eleventh rib, osseous portion only	430	510
" " twelfth rib " " "	490	500
" " thirteenth rib " " "	450	470
" " fourteenth rib " " "	410	460
" " fifteenth rib " " "	340	350
" " sternum (ossified portion)	700	840
" " " 1st segment	130	180
" " " 2d "	70	90
" " " 3d "	70	85
" " " 4th "	65	80
" " " 5th "	63	85
" " " 6th "	60	75
" " " 7th "	60	73
" " " 8th "	55	65
" " " 9th "	70	77
" " " supernum. cartilag. seg. (bet. 8th and 9th)	30	—

	No. 2920. ♂ 10 y'rs old	No. 2921. ♂ 15 y'rs old.
Length of scapula	830	370
Breadth of "	350	380
Greatest height of its spine	45	52
Length of humerus	300	285
Circumference of its head	300	290
Least circumference of the humerus	170	180
Length of radius	260	260
" " ulna	510	310
Longest diameter of upper end of ulna	100	130
Length of carpus	80	80
" " metacarpus and 1st digit	350	360
" " " " 2d "	310	320
" " " " 3d "	240	250
" " " " 4th "	200	2,050
" " " " 5th "	170	1,850
" " femur	170	220
Circumference of neck	125	120
Length of tibia	320	340
" " fibula	310	330
" " tarsus	140	160
" " metatarsus and 1st digit	310	270
" " " " 2d "	290	290
" " " " 3d "	290	270
" " " " 4th "	305	285
" " " " 5th "	227	310
" " innominate bone	320	360
Greatest width of the pelvis anteriorly	140	160
Length of ilium	140	160
" " ischio-pubic bones	140	200
" " thyroid foramen	—	200
" " os penis	170	170
Width of hand at base of digits	160	—
" " foot " "	130	140

The os penis (Fig. 13, Plate III) is 170 mm. long, slightly arched, somewhat flattened above, especially posteriorly, sharply convex below, and abruptly expanded and squarely truncate at the end. Its circumference at the base is 72 mm.; just behind the terminal expansion, 32 mm.; and the terminal expansion itself, 65 mm.

The above table gives the principal measurements of the bones of the skeleton. Measurements of both specimens are given, as in previous tables, for the purpose of illustrating the variations that occur in the relative size of different parts after maturity is attained, and also for the purpose of illustrating individual variation, which in some particulars these specimens exhibit in a marked degree. The ribs, it will be observed, differ but slightly in total length in the two; not nearly so much as would be expected from the much greater bulk of the body of the older specimen. It will be noticed that the principal differences in the ribs consist in the

relative length of the bony to the cartilaginous portions, in the older the ossified portion being much longer and the cartilaginous much shorter than in the other. An irregularity will be also observed in respect to the sternal segments, the younger specimen having a supernumerary cartilaginous one between the 8th and 9th normal ones.

Age and Sexual Variations. — In regard to the present species my material does not furnish many facts in respect to these points, since the two males contained in Captain Bryant's collection constitute at present my only resources. These examples, he writes me, were selected "as average specimens of full-grown males, but in the selection," he says, "we were governed somewhat by the desire to have skins perfectly haired, many of the animals being chafed by the rocks, even to having sores." "I should estimate," he further adds, "the age of one of them to be nine or ten years, that of the other fifteen." These specimens, however, differ considerably from each other in color, size, and proportions. Some of these differences are clearly due to age, but others equally great cannot be thus explained. These specimens show that the body increases greatly in bulk, and the bones in size and density, after the animal has reached its adult length. The crests of the skull are almost wholly developed after this period, and in great measure also the spines or ridges of the scapulæ. The processes for the attachment of the muscles also increase, as do the vertebral or osseous portions of the ribs. The teeth also change greatly in size and form after maturity is attained. They not only increase in size, especially the canines, but become much worn and misshapen by long use. In old specimens a greater or less proportion of the teeth are said to be either entirely wanting or broken, as is the case in the older of the two specimens before me.* Respecting the younger stages I am without data, as well as in respect to sexual variation. In these points the present species does not probably differ much from *Callorhinus ursinus*, adult females and the young of which are described further on. It is well known, however, that the females are much smaller than the males; as already suggested, they doubtless also lack the greatly developed sagittal and occipital crests of the males, as do the females of *C. ursinus* and *Otaria jubata*.

Individual Variation. — The present specimens, though only two in number and of different ages, indicate that the species under consideration is subject to a great amount of individual variation. This variation is strikingly shown in the skull, as seen in the following woodcuts (pp. 57 – 58). After allowing for the differences age would make, as in the smaller size of the sagittal crest, the rounded outline of the front edges of the intermaxillaries, the smaller size of the postorbital processes, the greater distinctness of the sutures, and perhaps the more sloping outline of the fore-

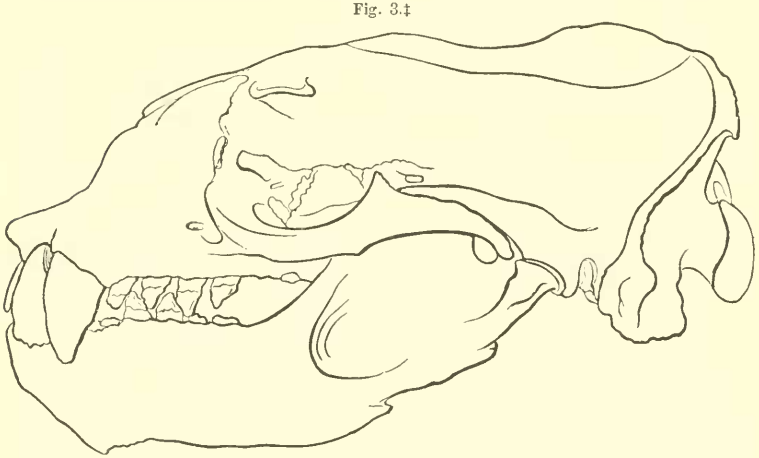
* See Fig. 3, Plate I.

Fig. 1.*

Fig. 2.†

head in the younger (Figs. 1 and 4), there is left a radical difference in the general form of the two skulls, which must have increased as the younger animal advanced in years. In length the two skulls vary only about a tenth of an inch; the younger, however, is considerably the narrower and much deeper, especially posteriorly, while its facial angle is much less. The direction of the latero-occipital crests, the form and projection of the occipital condyles, and especially their situation relative to the par-occipital processes, are exceedingly different in the two skulls, as clearly shown in Figs. 3 and 4, — as different as might be expected to occur in

Fig. 3.‡



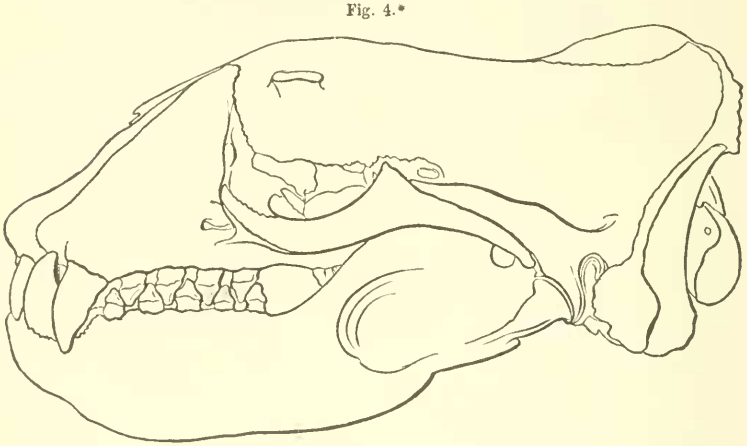
* Fig. 1, anterior portion of the skull of No. 2920 (left side), showing the form of the nasals, the zygomatic and postorbital processes, and the posterior outline of the intermaxillaries, seen from above.

† Fig. 2, same of No. 2921.

‡ Fig. 3, skull of No. 2921, seen in profile.

quite distinct species. In the anterior portion of the skull the differences are nearly as great as in the posterior portion. In the older skull the ratio of the height of the skull at the base of the second molar to its height at the base of the fourth is as 81 to 100; the corresponding ratio

Fig. 4.*



in the younger skull is as 74 to 100. It may be added that the same ratio in Dr. Gray's figure of the skull of *Zalophus Gillespii* † is as 70 to 100, showing that the younger skull in this character more resembles the *Z. Gillespii*, — which different writers have spoken of as remarkable for the great declination of the face, — than it does the older skull of the same species. There are also great differences in the relative length and shape of the nasal bones, and in the form of the posterior outline of the intermaxillaries (Figs. 1 and 2). In the younger specimen they extend further back than in the older, further even than the end of the nasals, while in the older the nasals extend beyond the intermaxillaries.

In respect to the posterior aspect of the skull (Figs. 2 and 4, Plate I), the differences are no less great. The height of the occipital bone is about fifteen per cent greater in the young skull (Fig. 2, Pl. I), which would be much increased by age through the further development of the supraoccipital crest. The breadth of the occiput above is equal in the two; below it is fifteen per cent greater in the older (Fig. 4, Pl. I).

In the lower surface of the skull (Figs. 1 and 3, Plate I) other considerable differences are observable, and of such a nature that they cannot be regarded as resulting from age. In the older skull, as previously remarked, the bones are in general much thicker than in the younger; but in re-

* Fig. 4, skull of No. 2920, same view.

† Proc. London Zool. Society, 1859, Pl. LXX.

spect to the hamuli pterygoidei, the younger skull has these processes longer and stouter than they are in the older. The posterior nares are narrower and higher in the younger, — a difference correlating with the general differences in form of the skull in the two specimens, the nares in the younger being relatively narrow and high as compared with those of the other. The comparative measurements of these skulls already given (p. 49) show definitely the amount of these differences. The palatine surface of the intermaxillaries is *less* depressed in the older skull.

In respect to other portions of the skeleton, considerable differences other than those obviously resulting from age are met with. The smaller and younger specimen, which has a girth in the mounted skin (as it doubtless had in life) one fourth greater than the other, has ribs as long as the other. The number of segments in the sternum varies in the two, through the intercalation in the younger specimen of a short cartilaginous one between the eighth and ninth, to which the ninth pair of ribs is attached, instead of both the eighth and ninth pairs being attached to the eighth segment, as is usually the case.

In color, contrary to what would result from age, the younger specimen is much the lighter.

Asymmetry. — A small amount of asymmetry has now come to be recognized as normally occurring in many groups of mammals, from which even the highest are not free. It is most marked, however, in the lower types, and especially in the cetaceans, where it is usually too great to escape the notice of the most cursory observer. The eared seals also exhibit an unusually great degree of asymmetry. This absence of symmetry doubtless indicates a tendency to a greater than the ordinary degree of individual variation. In the skull of the older specimen of *Eumetopias* now before me, the asymmetry is very striking, the preponderance of size being on the left side of the skull, which is not only broader, but appreciably longer. Besides the asymmetry of size, there is an asymmetry in the position of the different parts, those on one side being in advance of their homologues on the other side.* The following measurements indicate the extent of the asymmetry in size, the measurements being taken from the (homologically) median line outwards at four different points : —

Right side, ...	48	57	34	111
Left side, ...	53	63	39	113

* This one-sidedness is still more strikingly seen in the above-mentioned female skull of *Otaria jubata*, especially in regard to the size and position of the postorbital processes.

Dr. G. A. Maack informs me that in the specimens of the *O. jubata* collected by him on the coast of Buenos Ayres the asymmetry was astonishingly great. On the contrary, he found no asymmetry in the skull of the *Arctocephalus falklandicus*.

The palatine bones seem to be particularly liable to vary in length and form on the two sides of the same skull, as does also the position of the last molar tooth. On the left side the distance between the fourth and fifth molars in the older skull is 35 mm., on the right side 26 mm.

In the younger skull the left side is also just appreciably more developed than the right. In the older individual the asymmetry is readily traceable throughout the skeleton, in the hind feet especially, the one being much larger than the other.

General Remarks. — The northern sea lion was first described by Steller in 1751, who, under the name of *Leo marinus*, gave a somewhat detailed account of its habits and its geographical range, so far as known to him. His description of the animal, however, is quite unsatisfactory. Steller's *Leo marinus*, in size, general form and color, closely resembles the southern sea lion (*Otaria jubata*), with which Steller's animal was confounded by Pennant, Buffon and nearly all subsequent writers for nearly a century. Péron, in 1816, first distinctly affirmed the northern and southern sea lions to be specifically distinct. Lesson, in 1828, gave it the specific name it now bears, in honor of Steller, its first describer. The following year Fischer, on the authority of Lesson, also recognized its distinctness from the southern species. Nilsson, in 1840, in his celebrated monograph of the seals, reunited them. Müller, however, in an appendix to Dr. W. Peters's translation of Nilsson's essay, published in the Archiv für Naturgeschichte for 1841, separated it again, and pointed out some of the differences in the skulls that serve to distinguish the two species. Gray, in his Catalogue of the Seals published in 1850, also regarded it as distinct. But one is led to infer that he had not yet seen specimens of it, and that he rested his belief in the existence of such a species mainly on Steller's account of it, as he himself expressly states in his later papers. The skull received subsequently at the British Museum from Monterey, California, and figured and described by Gray as a new species, under the name of *Arctocephalus monteriensis*, proved, however, to be of this species, as first affirmed by Dr. Gill, and later by Professor Peters and Gray himself. With the exception of the figures of an imperfect skull of Steller's sea lion from Kamtchatka, given by Pander and D'Alton in 1826, Dr. Gray's excellent figure (a view in profile) is the only one of its skull hitherto published. The only specimens of the animal extant, up to a recent date, in the European museums, seem to have consisted of the two skulls and a stuffed skin in

the Berlin Museum mentioned by Peters, and the skull in the British Museum figured and described by Gray.

With the Monterey skull above mentioned, Dr. Gray received another very young skull, and the skin of a fur seal, both of which were said to have belonged to one animal, and which he hesitatingly referred to his *Arctocephalus monteriensis*.* Later, however, he regarded them as representing a new species,† which he called *Arctocephalus californianus*. Still later he again seems to refer them to his *Eumetopias Stelleri* ‡ (= *Arctocephalus monteriensis* Gray, of earlier date). Concerning this skin he remarked at one time as follows: "If the skin sent last year by Mr. Taylor to Mr. Gurney, and by that gentleman presented to the Museum, is the young of this species [*A. monteriensis*], the young animal is blackish, silvered by the short white tips to the short black hairs; those on the nape and hinder parts of the body with longer white tips, making those parts whiter and more silvery. The under-fur is very abundant, reaching nearly to the end of the hair. The end of the nose and sides of the face are whitish. The whiskers are elongated, rigid, smooth, and white. The hind feet are elongate, with rather long flaps to the toes. The skull is small for the size of the skin, and I should have doubted its belonging to the skin if it were not accompanied by the following label: 'Skull of the fur seal I sent last year. It is very imperfect, from my forgetting where I had put it; but it must do until accident throws another in the way; the other bones were lost. — A. S. T.'" §

As Dr. Gray seems to have finally become settled in his opinion that this skin is identical with his *A. monteriensis*, afterwards called by him *Eumetopias Stelleri*, this may account for the statement (already referred to in my "Résumé,") recently made by him ‖ and subsequently reiterated,¶ that the *Eumetopias Stelleri* is a species in which "the fur is very dense, standing nearly erect from the skin, forming a very soft, elastic coat, as in *O. falklandica* and *O. Stelleri*, which," he erroneously says, "are the only seals that have a close, soft, elastic fur." From his description of this young skull it is apparently refer-

* Proc. Lond. Zoöl. Soc., 1859, p. 358.

† Cat. Seals and Whales, 1866. p. 49.

‡ Ann. and Mag. Nat. Hist., 3d Series, 1866, Vol. XVIII, p. 233.

§ Proc. Lond. Zoöl. Soc., 1859, p. 358.

‖ Ann. and Mag. Nat. Hist., 4th Series, 1866, Vol. I, p. 101.

¶ Ibid., p. 215.

able to *E. Stelleri;* but the skin is unquestionably that of the *Callorhinus ursinus.* Nothing can be more sure than that it cannot belong to the *E. Stelleri, which is completely destitute of soft fur,* as proved by the specimens before me, and the description given by Professor Peters of the one in the Berlin Museum.

Lesson gave the name *Otaria californiana* to a supposed species of eared seal based solely on the "Jeune lion marin de la Californie" of Choris.* The figure given by Choris is too poorly drawn to be recognizable as that of one species of eared seal rather than of another. The following is the only allusion Choris makes to this animal in his text: "Les rochers, dans le voisinage de la baie San-Francisco sont ordinairement couverts de lions marins. Pl. XI." From the locality, which is the only possible guide, it was doubtless the *E. Stelleri,* but it may have been the *Zalophus Gillespii.* Dr. Gill in his "Prodrome," adopted provisionally Lesson's name (*californiana*) for the present species, but at the same time suggested its probable identity with the so-called *Otaria Stelleri* of Müller. Peters, a few months later, confirmed Gill's suggestion, since which time the name *Stelleri* has been universally adopted for the larger northern hair seal. The *Otaria Stelleri* of Schlegel,† formerly supposed by Gray‡ and also by Peters§ to include both the Australian eared seals (viz. *Arctocephalus cinereus* and *Zalophus lobatus*), has finally been referred by the latter, after an examination of the original specimens in the Leyden Museum, to the *Zalophus Gillespii.*‖ I am now convinced of the correctness of this determination, though for a time I suspected the skull of the young female figured in Fauna Japonica (Pl. XXII, Figs. 5 and 6) to belong to some species of fur seal. It certainly differs greatly in proportions, as well as in dentition, from the other skulls figured in this work (same plate), and called *O. Stelleri.*

The northern sea lion having become generally recognized as specifically distinct from the sea lion of the southern seas, Dr. Gill, in 1866, separated the two generically. This had indeed already been done practically by Dr. Gray, inasmuch as he placed his *A. monteriensis* (=*O.*

* Voyage Pittoresque, Pl. XI, of the chapter entitled "Port San-Francisco et ses habitants." (The date of this work is 1822.)

† Fauna Japonica, Mam marine, p. 10.

‡ Ann. and Mag. Nat. Hist., 3d Series, 1866, Vol. XVIII, p. 229.

§ Monatsberichte Akad. Berlin, 1866, pp. 272, 276.

‖ Ibid., p. 669.

Stelleri auct.) in the genus *Arctocephalus*, and the southern sea lion in *Otaria*, with which he nominally associated the *O. Stelleri*. He failed, however, to recognize the identity of his *A. monteriensis* with the *O. Stelleri*, and hence the entire generic diversity of the northern and southern sea lions seems to have escaped his observation. The latter fact was first pointed out by Dr. Gill in his "Prodrome," as above stated.

Comparison with OTARIA JUBATA. — Having only male specimens of the *Eumetopias Stelleri*, and only skulls of the female of *Otaria jubata*, I am unable to make a detailed comparison of these two strictly geographically representative species. The following measurements of a female *O. jubata*, taken from the animal itself (at Cabo Corrientes, Buenos Ayres), by Dr. G. A. Maack, are here introduced for future reference, since they are more detailed than any hitherto published: —

"*Measurements of* OTARIA JUBATA (*adult*).

"Total length to end of tail	1,750 mm.
" " " " " outstretched hind limbs	2,070 "
Greatest circumference of the body	1,050 "
Circumference of the body in front of fore limbs	970 "
" " " hind limbs	860 "
" of the neck	620 "
Length of left fore fin	700 "
" " palm	500 "
" " hind fin (sole)	430 "

"The general color is brown; iris, coffee-brown; barbules, dark yellow."

Of the large collection of skins and skeletons of the *Otaria jubata* received by the London Zoölogical Society in 1868, we as yet have no very detailed account. The measurements of one of the adult females given by Dr. Murie * are as follows: "Greatest length of skin, including hind extremities, 80½ inches [2,045 mm.]; from muzzle to end of tail, 66½ inches [1,702 mm.]; tip to tip of fore limbs outspread, 58 inches [1,473 mm.]" It hence agrees very nearly in size with that measured by Dr. Maack.

The measurements of a male specimen of *O. jubata* — belonging to the same collection as the female — given by Dr. Murie, indicate that it was not nearly full grown. The few reliable facts we have in

* Proc. Zool. Soc. 1869, p. 102.

respect to the size of the male are sufficient to show that in this respect, as well as in general external features, the *O. jubata* differs markedly in no way from the *Eumetopias Stelleri*, although they differ widely in the form of the skull and in dentition.

Geographical Distribution. — According to Steller, this species existed in his time along nearly the whole eastern coast of Kamtchatka and southwards to the Kurile Islands. He also met with it on Behring's Island and on the American coast. Both Captain Bryant and Mr. Dall report it as abundant at the Pribyloff Islands, and it has been received by Dr. Gray, and also, as Dr. Gill informs me, at the Smithsonian Institution, from California. The sea lions of the Farallone Islands and other parts of the California coast, especially those that have of late attracted so much attention in the harbor of San Francisco, are probably the present species. The *E. Stelleri* hence doubtless ranges along the American coast, in greater or less abundance, from California to Behring's Strait, and down the Asiatic coast to the Kurile Islands.

Habits. — The habits of this species have not yet been minutely described. Steller gave a very full account of those of the sea bear (*Callorhinus ursinus*), and remarked that, with some few exceptions (which he specifies), those of the sea lion closely resemble those of that animal. Captain Bryant has also been far more minute in his account of the sea bear; but in the subjoined notes respecting the sea lion he presents interesting information regarding the latter species. The Plates of Choris (Nos. XIV and XV of the chapter on the Aleutian Islands) doubtless give a very good idea of the appearance of these animals and the sea bears when assembled on the land. He has also contributed a few interesting facts concerning their habits. The following are the remarks of Captain Bryant: —

"The sea lion visits St. Paul's Island in considerable numbers to rear its young. It is one of the largest of the seal family, the male frequently measuring thirteen feet in length, and weighing from fifteen to eighteen hundred pounds. Its habits are the same as those of the fur seal. When roused to anger it has a very marked resemblance, through the form of its head and neck, to the animal from which it is named, and its voice, when roaring, can be heard to a great distance. Its body is thickly covered with fine, short, dark [?] brown hair, without any fur. Its skin is of considerable value as an article of commerce in the territory, it being used in making all kinds of boats, from a one-man

canoe to a lighter of twenty tons' burden. The natives of all the Aleutian Islands and of the coast as far east as Sitka, beside those of many ports on the mainland to the north, rely on this island for a supply of the skins of this animal. The rookery is on the northeast end of the island, and the animals have to be driven ten or eleven miles to the village to bring their skins to the drying-frames. It sometimes requires five days to make the journey, as at frequent intervals they have to be allowed to rest. It is a somewhat dangerous animal, and the men frequently get seriously hurt by it in driving and killing it. They are driven together in the same manner as the fur seals are; and while impeding each other by treading upon each other's flippers the small ones are killed with lances, but the larger ones have to be shot.

"This animal is the most completely consumed of any on the island. Their flesh is preferred to that of the seal for drying for winter use. After the skins are taken off (two thousand of which are required annually to supply the trading-posts of the territory), they are spread in piles of twenty-five each, with the flesh side down, and left to heat until the hair is loosened; it is then scraped off, and the skins are stretched on frames to dry. The blubber is removed from the carcass for fuel or oil, and the flesh is cut in strips and dried for winter use. The linings of their throats are saved and tanned for making the legs of boots and shoes, and the skin of the flippers is used for the soles. Their stomachs are turned, cleaned, and dried, and are used to put the oil in when boiled out. The intestines are dressed and sewed together into water-proof frocks, which are worn while hunting and fishing in the boats. The sinews of the back are dried and stripped to make the thread with which to sew together the intestines, and to fasten the skins to the canoe-frames. The natives receive thirty-five cents apiece for the skins when ready for shipment. But these skins are not so much valued by the trader for the profit he makes on their sale, as for the advantage it gives him in bargaining with the hunters, since by buying these they are able to secure a right to the purchase of the hunter's furs on his return, the natives always considering such contracts binding."

Choris, in his description of the "Iles S.-Georges et S.-Paul's," thus speaks of the sea lions that he met with on these islands fifty years ago: —

"Le rivage etait couvert de troupes innombrables de lions marins.

L'odeur qu'ils répandent est insupportable. Ces animaux étaient alors dans le temps du rut. L'on voyait de tous côtés les mâles se battre entre eux pour s'enlever les uns aux autres les femelles. Chaque mâle en rassemble de dix à vingt, se montre jaloux, ne souffre aucun autre mâle, et attaque ceux qui tentent de s'approcher; il les tue par ses morsures ou s'en fait tuer. Dans le premier cas, il s'empare des femelles du vaincu. Nous avons trouvé plusieurs mâles étendus morts sur la plage, des seules blessures qu'ils avaient reçues dans les combats. Quelques femelles avaient déja des petits. Les Aléoutes en prirent plusieurs douzaines pour nous. L'animal n'est pas dangereux; il fuit à l'approche de l'homme, excepté depuis la mi-mai jusqu'à la mi-juin, qui est le plus fort temps du rut, et où les femelles mettent bas leur petits; alors il ne se laisse pas approcher et il attaque même."

"Ces animaux sont aussi très-communs au port de San-Francisco, sur la côte de Californie, où on les voit en nombre prodigieux sur les rochers de la baie. Cette espèce m'a paru se distinguer de ceux qui fréquentent les îles Aléoutiennes; elle a le corps plus fluet et plus allongé, et la tête plus fine: quant à la couleur, elle passe fortement au brun, tandis que ceux des îles Aléoutiennes sont d'une couleur plus grise, ont le corps plus rond, les mouvements plus difficiles, la tête plus grosse et plus épaisse; la couleur du poil des monstaches plus noirâtre que celui des îles Aléoutiennes.

"On trouve les lions marins depuis le 30ème jusqu'au 60ème parallèle nord, dans les îles et sur le continent d'Amérique."

"On y [l'île Saint-Georges] tue une grande quantité de lions marins; mais seulement des mâles, à cause de leur grandeur; on se sert de leur peau pour recouvrir les canots, et des intestins pour faire le *kamleyki*, espèces de blouses que l'on endosse par dessus les autrs vêtements lorsqu'il pleut pour ne pas se mouiller. La chair, que l'on fait sécher, est dure; c'est une bonne nourriture pour l'hiver. . . . . Les jeunes sont très-tendres et ont le goût de poisson." *

The following careful description of their movements on land has been communicated to me by Mr. Theodore Lyman, who has recently observed the sea lions on the "Seal Rocks" near San Francisco:—

"These rocks," he says, "are beset with hundreds of these animals,—some still, some moving, some on the land, and some in the water. As

* Voyage Pittoresque autour du Monde, Chapter "Iles Aléoutiennes," p. 12-14.

they approach to effect a landing, the head only appears decidedly above water. This is their familiar element, and they swim with great speed and ease, quite unmindful of the heavy surf and of the breakers on the ledges. In landing, they are apt to take advantage of a heavy wave, which helps them to get the forward flippers on *terra firma*. As the wave retreats, they begin to struggle up the steep rocks, twisting the body from side to side, with a clumsy worm-like motion, and thus alternately work their flippers into positions where they may force the body a little onward. At such times they have a general appearance of *sprawling* over the ground. It is quite astonishing to see how they will go up surfaces having even a greater inclination than 45°, and where a man would have to creep with much exertion. When the surface is nearly horizontal, they go faster, and often proceed by gathering their hind-quarters under them, raising themselves on the edges of their fore-limbs and then giving a push, whereby they make a sort of tumble forwards. In their onward path they are accompanied by the loud barking of all the seals they pass; and these cries may be heard a great distance. Having arrived at a good basking-place, they stretch themselves out in various attitudes, — often on the side, sometimes nearly on the back, but commonly on the belly, with the flippers somewhat extended. They seem much oppressed with *their own weight* (which is usually supported by the water), and it seemed an exertion for them even to raise the head, though it is often kept up for a long time. They play among themselves continually by rolling on each other and feigning to bite. Often, too, they will amuse themselves by pushing off those that are trying to land. All this is done in a very cumbrous manner, and is accompanied by incessant barking. As they issue from the water, their fur is dark and shining; but, as it dries, it becomes of a yellowish brown. Then they appear to feel either too dry or too hot, for they move to the nearest point from which they may tumble into the sea. I saw many roll off a ledge at least twenty feet high, and fall, like so many huge brown sacks, into the water, dashing up showers of spray."

From the accounts given by various observers, the sea lions evidently move with much less facility on land than do the fur seals. Captain Bryant states that the fur seals may be driven at the rate of a mile and a half per hour, while he asserts that the sea lions can be driven with safety only about two miles a day.

Genus Zalophus *Gill.*

Zalophus Gill, Proc. Essex Institute, 1866, V, 7, 11. Type *Otaria Gillespii* McBain.

Zalophus Peters, Monatsb. Akad. Berlin, 1866, 275, 671.

Neophoca Gray, Ann. and Mag. Nat. Hist., 3d Series, 1866, XVIII, 231. Type *Arctocephalus lobatus* Gray.

Size medium. Molars approximated, last under the hinder edge of the zygomatic process. Muzzle narrow. Superior profile, from the postorbital process anteriorly, gently declined. Bony palate moderately contracted posteriorly, and but slightly depressed. Hinder edge of the palatals deeply concave. Pterygoid hooks slender. Posterior nares broader than high; anterior higher than broad. Postorbital cylinder narrow and elongate. The postorbital constriction of the skull is deep and abrupt, giving a quadrate or subquadrate form to the brain-box, which varies to triangular through the varying degree of prominence of its latero-anterior angles. The postorbital processes are triangular, developed latero-posteriorly into a rather slender point. The sagittal crest forms a remarkably high, thin bony plate, unparalleled in its great development in any other genus of the family. The general form of the skull is rather narrow, much more so than in *Eumetopias*, and nearly as much so as in *Arctocephalus;* the breadth to length being as 60 to 100.

Zalophus, so far as the skull is concerned, is the most distinct generic form of the family *Otariadæ*, it being thoroughly distinct from all the others. It differs from *Otaria* in having one less pair of upper molars, in the less depression of the bony palate, the less extension posteriorly of the palatines, the much narrower muzzle, the much less abrupt declination of the facial profile, its much higher sagittal crest, and in its narrower and more elongated form.

Zalophus differs from *Eumetopias*, as already pointed out, in having all the upper molars closely approximated, in the concave outline of the posterior border of the palatines, and otherwise much as it differs from *Otaria*.

Zalophus differs from *Callorhinus* in its less number of upper molars, its high sagittal crest, and in the more declined profile of the face. It differs in a nearly similar manner from *Arctocephalus*, but more resembles this genus in the general form and proportions of the skull than any other. But in the nature of its pelage, and in other external features, it is radically distinct from the whole group of fur seals, as it is also in its high sagittal crest.

Zalophus Gillespii *Gill.* GILLESPIE'S HAIR SEAL.

Otaria Gillespii McBAIN, Proc. Edinb. Roy. Phys. Soc., I, 422, 1858.
Arctocephalus Gillespii GRAY, Proc. Lond. Zoöl. Soc., 1859, 110, 360, Pl. LXX; Cat. Seals and Whales, 1866, p. 55.
Zalophus Gillespii GILL, Proc. Essex Inst., V, 13, 1866.
Otaria (Zalophus) Gillespii PETERS, Monatsb. Akad. Berlin, 1866, 275, 671.
Zalophus Gillespii GRAY, Ann. and Mag. Nat. Hist., 3d Series, 1866, XVIII, 231.
Otaria Stelleri SCHLEGEL, Fauna Japonica, Mam. marin, 10, Pl. XXI, (animal), Pl. XXII, Figs. 1–4, and 5–6 (skulls), Pl. XXIII, Figs. 1–9 (skeleton and teeth), 1842.
"*Otaria japonica* SCHLEGEL, MS." Peters.

Color. — In color, as well as in general form, this species is similar to *E. Stelleri*, but in size it is much smaller. Being without skins of this species, I borrow the following from Schlegel's description in the Fauna Japonica. In describing Japan specimens (under the name *Otaria Stelleri*) he says the tints of the upper parts are "d'un gris jaunâtre, un peu nuancé de noir sur le dos et sur la tête. Sur les parties inférieures et sur les extrémités, la teinte générale dont nous parlons, passe insensiblement au brun-roux; mais cette couleur est très-peu marquée sur le dessous du cou, tandis qu'elle devient très-foncée vers l'extrémité des pieds, qui sont d'un brun-roux noir assez profond." "Les poils," he adds, "sont en général courts, puisqu'ils ne portent guère que trois à quatre lignes en longueur sur le cou ou sur le dos, un peu raides et assez touffus. Ils sont, sur les parties supérieures, bruns à la base et noirs au milieu, mais leur pointe offre toujours des couleurs plus claires, qui forment les teintes générales de l'animal." The specimen above described he states is a female, and remarks that another female he possessed differs from it in color only in being generally darker or more deeply colored.

Size. — The mounted skin of an adult male preserved in the Museum of the Pays-Bas, he says, is "six pieds et deux pouces en longueur totale, mesuré depuis le nez jusqu'à l'extrémité de la queue." It differs from a female specimen, he says, only in being larger and darker colored and in having the hairs longer.

The only specimens of this species I have been ab'e to examine are two skulls, one of which was kindly loaned me by the Chicago Academy of Sciences, and the other by the Smithsonian Institution. The former belongs to a mounted skeleton, collected, as Dr. Stimpson informs me, by Professor W. P. Trowbridge, formerly Lieutenant of United States Engineers somewhere between Puget Sound and San Francisco. The skeleton, without the atlas and skull, Dr. Stimpson writes me, measures six feet; adding the length of the latter gives a little less than seven feet as the whole length of

the skeleton. The sex of neither of these specimens was recorded, but there seems to be little doubt of their being both males. Both are very old individuals. They differ considerably in size, however, as will be seen by the accompanying table of measurements, the Chicago Academy specimen being the larger.

Measurements of the Skull.

	♂*	♂†
Length	330	290
Breadth	180	170
Dist. from ant. edge of intermaxillaries to hamuli pterygoidei	190	180
" " " " " last molar	100	97
" " " " " front edge of orbit	95	90
" " " " " post. " "	160	150
" " " " " auditory orifice	245	220
Length of left palatine bone (inner edge)	35	34
" " right " " "	—	36
Breadth of left " " (anteriorly)	21	19
" " right " " "	—	18
Dist. from post. edge of palatals to end of hamuli pteryg.	55	48
" " last molar to end of hamuli pteryg.	90	80
Depression of palate below alveoli of canines	10	07
" " " " 3d molar	09	08
" " " " last molar	—	10
Length of the nasals (outer edge)	61	56
" " " (inner edge)	49	38
Breadth of both nasals together (anteriorly)	30	27
" " " " (posteriorly)	28	20
" of the skull at the canines	70	60
" " " " postorbital process	83	66
" " " " middle of the orbits	145	130
" " " " maxillary condyles	190	170
" " " " paroccipital process	165	163
Diameter " anterior nares (vertical)	32	30
" " " " (transverse)	34	29
" " posterior nares (vertical)	30	23
" " " " (transverse)	28	26
Length of the zygomatic foramen	117	82
Breadth " " "	65	55
Diameter of foramen magnum (antero-posterior)	24	25
" " " (laterally)	25	23
Height of the skull (end of parac. proc. to top of occip. crest)	150	120
" " " (occip. condyle to top of occip. crest)	130	97
" " " (end of ham. pteryg. to top of sag. crest)	140	125
Length of sagittal crest	157	145
Greatest height of crest	38	29
Length of the lower jaw	240	200
Breadth posteriorly	170	155
" at last molar	75	75
" posterior edge of symphysis	53	64
" of each condyle	55	47
Height of lower jaw at coronoid process	90	75
" " " symphysis	45	37

* Received from the Chicago Academy of Sciences.

† Received from the Smithsonian Institution (S. I. No. 261).

According to Peters, the length of the skull of *O. Gillespii* is 295 mm.; of one of the skulls of *O. japonica* (Schlegel MS. = *O. Stelleri* of the Fauna Japonica) is 270 mm. and of the other 310 mm., which would indicate an animal of about three fourths the size of *E. Stelleri*.

If we can assume that the California "lion marin" of Choris* is this species, which we can hardly do with certainty, it differs from the *E. Stelleri* in being browner and smaller, with a more delicately shaped head and darker mustaches. The latter, however, are variable in color, in other species, in specimens specifically the same.

Individual Variation. — The two male skulls of *Zalophus Gillespii* before me differ from each other very remarkably in various points. Besides the general difference in size indicated in the above table of measurements, there are other and more radical differences in proportions and form. In the specimen received from the Chicago Academy, the general form is much more elongated than in the other, especially the facial portion of the skull and the postorbital cylinder. The nasals are especially longer, and the expanded interorbital space shorter, with the postorbital processes much more heavily developed. The brain-box, seen from above, through the gradually sloping postorbital constriction, is *triangular*, whilst in the other, through the abruptness of the postorbital constriction, it is *quadrate*. Hence in the latter the brain-box has distinct latero-anterior angles, whilst in the other the lateral walls of the brain-box gradually and regularly converge anteriorly. The differences in these respects are far greater than exist between the two male skulls of *Callorhinus ursinus* represented in Plate II. The following proportions indicate the extent of the differences seen in the form of the postorbital cylinder.

The diameter of this part, at its point of greatest constriction, in the specimen received from the Smithsonian Institution is 23 mm.; do. of the specimen received from the Chicago Academy of Sciences, 35 mm. The length of the postorbital cylinder in the first is 43 mm.; in the latter, 69 mm., or *nearly one and a half times longer than in the other;* whilst the difference in the whole length of the skull in the two specimens is less than *one seventh* of the length of the smaller specimen. Species, and even genera, have been based on differences of less importance than these.

General Remarks. — Schlegel, in the work above cited, gave the first and thus far the fullest account we possess of this species. He also gave figures of several skulls, of a skeleton, and of a middle-aged female. He failed, however, to distinguish this species from the *Z. lobatus* and the *Eumetopias Stelleri*, but confounded the three under the name *Otaria*

* Voyage Pittoresque (Iles Aléoutiennes, p. 13).

Stelleri. He also omitted to state distinctly the localities at which the specimens figured were obtained, though they were doubtless from Japan.

As already remarked under *Eumetopias Stelleri*, naturalists for a long time referred the specimens figured by Schlegel under the name *Otaria Stelleri* to two widely distinct species, namely, *O. lobata* (*Zalophus lobatus*) and *O. cinerea* (*Arctocephalus cinereus*). It was only four years since that Professor Peters, after examining the specimens figured in the Fauna Japonica, was able to determine the real character of Schlegel's *O. Stelleri*, which he found referable to the *O. Gillespii* McBain. As previously stated, I see no reason to question the correctness of this identification. The skull represented in Figures 5 and 6, Plate XXII, is said to be that of a young female; the great proportional differences apparent between this and the other specimens figured are only such as might result from age.

The references to this species are very few. The first, aside from Schlegel's above-cited work, is the description of a skull from California by McBain, in which the animal in question was first indicated as a distinct species. This skull was described in 1858, and was the basis of McBain's species *O. Gillespii*. In the following year Dr. Gray published a figure of a cast of this skull, and re-described the species from the cast, under the generic name of *Arctocephalus*. Dr. Gill having seen other skulls, and noticing the striking differences existing between this and the other forms, in his "Prodrome" he proposed for this species the generic name of *Zalophus*.

The only species with which *Zalophus Gillespii* seems to be at all closely related is its congener the *Z. lobatus*, with which, as stated above, it was supposed by Schlegel to be identical, and to which it was in part or wholly referred by later writers. The two are of nearly the same size, and seem to have, in general, similar external features. According to Peters and Gray they differ, however, in the form of the teeth and in respect to some of the features of the skull.

Distribution and Habits. — The only localities from which this species is at present certainly known, are California and Japan, but it doubtless inhabits the intermediate shores of the Pacific. Mr. W. H. Dall informs me, however, that he is confident that there is only one species of "eared sea lion in Behring's Sea." He affirms most positively that "there is no *Zalophus* there, or at San Francisco," the species frequenting the rocks in the harbor of that name being the *Eu-*

metopias Stelleri. Captain Bryant writes me that he feels quite sure two species of sea lions inhabit the coast of California and the other Pacific States, but he has not yet had an opportunity of carefully examining them. The three specimens from the west coast of the United States already in collections, — that described by Dr. McBain, the one in the Museum of the Smithsonian Institution, and that in the Museum of the Chicago Academy, — sufficiently establish its occurrence on the California coast. There seems to be nothing known, or at least on record, concerning its habits.

Subfamily II. — OULOPHOCINÆ.

With thick under-fur; size smaller, form slenderer, and the ears relatively much longer than in *Trichophocinæ*. Digital swimming flaps of the hind feet very long. Molars $\frac{6}{5} = \frac{6}{5} = \frac{12}{10}$.*

Genus Callorhinus Gray.

Callorhinus Gray, Proc. Lond. Zoöl. Soc., 1859, 359. Type "*Arctocephalus ursinus* Gray," = *Phoca ursina* Linné.

Arctocephalus Gill, Proc. Essex Inst., V, 7, 1866. Same type; not *Arctocephalus* F. Cuvier.

Facial portion of the skull broad and greatly produced. Otherwise essentially the same as in *Arctocephalus*.

Callorhinus and *Arctocephalus* are sufficiently distinguished from the hair seals by the character of the pelage, as well as by the other characters given above in the diagnoses of the two groups of hair and fur seals. *Callorhinus* differs apparently from *Arctocephalus* mainly, if not almost solely, in the greater prominence of the facial portion of the skull. Between these two groups there are not such radical differences in the form of the skull as are met with in the several genera of the hair seals, by means of which *Otaria*, *Eumetopias*, and *Zalophus* are so trenchantly separated from each other. *Callorhinus* and *Arctocephalus*, though closely allied forms, are probably generically separable.

Callorhinus ursinus Gray. Northern Sea Bear.

Ursus marinus Steller, Nov. Comm. Academ. Petrop., II, 331, Pl. XV, 1751.

Phoca ursina Linné, Syst. Nat., I, 37, 1758. (From Steller.)

"*Phoca ursina* Schreber, Saugeth., III, 289, 1758. (From Steller.)"

Phoca ursina Shaw, Gen. Zoöl., I, 265, Pl. LXII, 1800.

" " Fischer, Synop. Mam., 231, 1829.

" " Pallas, Zoog. Rosso-Asiat., I, 102, 1831.

* For a more extended comparison of *Oulophocinæ* with *Trichophocinæ*, see above, pp. 21–23.

Phoca nigra Pallas, Zoog. Rosso-Asiat., I, 107. (Young.)
Otaria ursina Péron, Voy. Terr. Austr., II, 41, 1816.
" " Desmarest, Nouv. Dict. Hist. Nat., XXV, 595, 1817.
" " Desmarest, Mam., I, 249, 1820.
" " Gray, Griffith's An. Kingd., V, 182, 1827.
" " Nilsson, Archiv f. Naturgesch. 1841 (in part).
" " J. Müller, Ibid., 333.
" " A. Wagner, Ibid , 1849, 39.
Otaria Kraschenninikowii Lesson, Dict. Class. Hist. Nat., XIII, 419, 1826.
Otaria Fabricii Lesson, Ibid , 420.
Otaria (Callorhinus) ursinus Peters, Monatsb. Akad. Berlin, 1866, 373, 672.
Arctocephalus ursinus Gray, Cat. Phocidæ, 41, 1850; not *A. ursinus* F. Cuv., or only in part.
" " Gray, Proc. Lond. Zoöl. Soc., 1859, 103, 107, Pl. lxxiii, skull.
" " Gill, Proc. Essex Inst., V, 13, 1866.
Callorhinus ursinus Gray, Proc. Lond. Zoöl. Soc., 1859, 359.
" " Gray, Cat. Seals and Whales, 44, 1866.
" " Gray, Ann. and Mag. Nat. Hist., 3d Ser., XVIII, 234, 1866.
Arctocephalus monteriensis Gray, Proc. Lond. Zoöl. Soc , 1857, 360 (in part).
Arctocephalus californianus Gray, Cat. Seals and Whales, 51, 1866 (in part).
Sea Cat, Kraschenninikow, Hist. Kamt., 306, 1764.
Ours Marin, Buffon, Hist. Nat., Suppl., VI, 336, Pl. xlvii, 1782 (in part).
Ursine Seal, Pennant, Hist. Quad., I, 526, 531, 1792 (in part).

Color — (*Male.*) General color above, except over the shoulder nearly black, varying in different individuals of equal age from nearly pure black to rufo-grayish black. Over the shoulders the color is quite gray. The sides of the nose and the lips are brownish, as is a considerable space behind the angle of the mouth, and a small spot behind the ear. The neck in front is more or less gray. The breast and the axillæ are brownish-orange. The limbs are reddish-brown, especially near their junction with the body, as is also the abdomen. The hairs individually vary considerably in color, some being entirely black nearly to their base, and others entirely light yellowish-brown; others are dark in the middle and lighter at each end. The naked skin of the hind limbs, the nose, and the anal region is black.

(*Female.*) The general color of the female is much lighter than that of the male. Above it is nearly uniformly gray, varying to darker or lighter in different individuals and with age. The color about the mouth is brownish, varying to rufous, of which color are the axillæ, the breast, and the abdomen. The sides are brownish-gray. At the base all the hairs are usually brownish, like the under-fur, with a broad subter-

minal bar of black, and tipped for a greater or less distance with gray. The variation in different individuals in the general color results from the varying extent of the gray at the ends of the hairs.

(*Young.*) The general color of the upper surface of the body in the young, previous to the first moult, is uniformly glossy black. The region around the mouth is yellowish-brown. The neck in front is grayish-black. The axillæ are pale yellowish-brown; a somewhat darker shade of the same color extends posteriorly and inward towards the median line of the belly, uniting on the anterior portion of the abdomen. The greater part of the lower surface, however, is dusky brownish-gray, the rest being black, but less intensely so than the back. Specimens of equal age vary much in color, one of the young specimens corresponding nearly with the above description, while the other is much darker.

On the head and sides of the neck a portion of the hairs are found, on close inspection, to be obscurely tipped with gray. After the first moult the pelage becomes gradually lighter, through the extension of the gray at the tips of the hairs, especially in the females, the two sexes being at first alike. Contrary to what has been asserted, the young are provided from birth with a long thick coat of silky under-fur, of a lighter color than the under-fur of the adults

The Hair. — The double pelage consists of an outer covering of long, flattened, moderately coarse hair, beneath which is a dense coat of long fine silky fur, which reaches on most parts of the body nearly to the ends of the hairs. The hairs are thicker towards the ends than at the base, but their clavate form is most distinctly seen in the first pelage of the young. In length the hair varies greatly on the different parts of the body. It is longest on the top of the head, especially in the males, which have a well-marked crest. The hair is much longer on the anterior half of the body than on the posterior half, it being longest on the hinder part of the neck, where in the males it is very coarse. On the crown the hair has a length of 42 mm.; on the hinder part of the neck it reaches a length of 50 to 60 mm. From this point posteriorly it gradually shortens, and near the tail has a length of only 20 mm. It is still shorter on the limbs, the upper side of the digits of the hind limbs being but slightly covered, while the anterior limbs are quite naked as far as the carpus. The males have much longer hair than the females, in which it is much longer than in *Eumetopias Stelleri.**

* From the descriptions of most writers it would seem that the *Otaria jubata* is provided with a conspicuous mane, but in the few accurate descriptions in which the length of the longest hairs is given, the so-called "flowing mane," — which refers only to the greater length of the hairs on the neck and shoulders as compared with the other regions of the body, — does not appear to be any more truly a mane than in *Eumeto-*

The whiskers are cylindrical, long, slender, and tapering, and vary with age in length and color. In the young they are black; later they are light colored at the base, and dusky at the ends. In mature specimens they are either entirely white, or white at the base and brownish-white towards the tips.

Size. — The length of a full-grown male, according to the present specimens (see the table of measurements on page 77), is between seven and eight feet; and of a full-grown female, about four feet. Captain Bryant states* that the males attain mature size at about the sixth year, when their total length is from seven to eight feet, their girth six to seven feet, and their weight, when in full flesh, from five to seven hundred pounds. The females, he says, are full grown at four years old, when they measure four feet in length, two and a half in girth, and weigh eighty to one hundred pounds. The yearlings, he says, weigh from thirty to forty pounds.

Ears. — The ears (Fig. 12, Pl. II, one half nat. size) are long, narrow, and pointed,† being absolutely longer than those of the *E. Stelleri*, though the latter animal is two or three times the larger.

Fore Limbs. — The hands (Fig. 11, Pl. II, $\frac{1}{20}$th nat. size) are long and narrow, with a broad cartilaginous flap extending beyond the digits, which has a nearly even border. Both surfaces are naked the whole length; not covered above with short hair, as in *Eumetopias* and *Otaria*. The nails are rudimentary, their position being indicated by small circular horny disks, as in all the other eared seals.

Hind Limbs. — The feet (Fig. 12, Pl. II, $\frac{1}{20}$th nat. size) are very long, nearly half their length being formed by the cartilaginous flaps that project beyond the ends of the toes. They widen much less from the tarsus to the ends of the toes than these parts do in *E. Stelleri*, and the length of the toe-flaps is relatively many times greater than in the latter species. The toes of the posterior extremities are of nearly equal length. The outer are slightly shorter than the three middle ones. The nails of the outer toes are rudimentary and scarcely visible; — those of the middle toes are strong and well-developed.

pias Stelleri, *Callorhinus ursinus*, *Arctocephalus cinereus*, or *A. falklandicus*. All the sea bears and sea lions, according to authors, have the hair much longer on the anterior than on the posterior half of the body; and in the hair seals it is not longer than in the fur seals. The resemblance to the mane of the lion, with which in several species this longer hair has been compared, is doubtless partly imaginary and partly due to the loose skin on the neck and shoulders being thrown into thick folds when these animals erect the head. I have not, however, seen the distinct crest formed by the long hairs on the crown of the male of *C. ursinus* mentioned as occurring in the other species, unless it is alluded to in the specific name *coronata*, given by Blainville to a South American specimen of fur seal. It is certainly not possessed by the *E. Stelleri*.

* See beyond, p. 95.

† They are accidentally represented too broad in the figure.

External Measurements.

	No. 2922, Adult ♂		No. 2923, Adult ♂	No. 2924, Adult ♀	No. 2925, Adult ♀		No. 2926, Young ♀ (35 days old).	No. 2927, Young ♀ (35 days old).	Young ♂	Adult ♀ ("6 y'rs old").	Young ♂ *Arctocephalus falklandicus.*
	Unmounted.	Mounted.	Mounted.	Mounted.	Unmounted.	Mounted.	Mounted.	Mounted.	Animal.	Animal	Animal.
Length of body	2,311	2,390	2,470	1,350	1,118	1,160	840	860	1,270	1,092	1,180
" " tail	—	53	47	54	—	50	15	18	26	50	—
" from nose to end of outstretched hind limbs	2,472	2,740	2,860	1,790	—	1,750	1,015	1,020	—	—	—
" of fore limb	452	470	460	320	317	315	170	190	357	357	550
Breadth of hand	229	225	220	140	—	130	75	85	135	101	—
Length of hind limb	—	515	500	400	432	390	175	200	406	357	450
Breadth of foot at tarsus	—	145	135	78	—	80	55	57	75	76	—
" " ends of toes	—	250	210	150	—	130	110	120	127	101	—
Length of toe-flaps of hind feet (average)	—	225	200	190	—	160	80	75	—	—	—
Distance from end of nose to eye	96	95	85	75	—	70	50	52	76	62	—
" " " ear	254	255	260	180	—	190	120	130	178	152	—
" between the eyes	127	137	105	78	—	75	53	55	—	—	—
" " " ears	246	360	315	225	—	205	150	156	152	?152	—
Length of the ear	50	44	50	35	—	33	34	33	38	38	—
" " longest barbule	180	180	185	175	—	140	65	65	—	—	—
Distance between the ends of outstretched fore limbs	2,083	—	—	—	1,321	—	—	—	—	—	—
Circumference of body in front of fore limbs	—	1,720	1,650	930	—	900	555	500	914	711	970
" " " hind limbs	—	680	670	410	—	460	260	260	357	266	—
" head at the ears	—	770	820	490	—	550	315	330	--	—	—

Measurements. — The preceding table of external measurements indicates the general size of the adult males and females, and the young at thirty-five days old. In some respects the dimensions are only approximately correct, being taken from mounted specimens; in the main, however, they are sufficiently accurate. A few measurements taken from the soft skin are also given; the making of a complete series of measurements of the skins before they were mounted was accidentally omitted. In addition to the six specimens of Captain Bryant's collection, I am indebted to Mr. W. H. Dall for measurements of a male and a female, taken by him * from the animals immediately after they were killed. The female (said by Mr. Dall to be six years old) is evidently adult, but the male, from its but little larger size, seems not to have been fully grown. In the last column of the table a few measurements are given of a male specimen of the *Arctocephalus falklandicus*, taken by Dr. G. A. Maack, from a fresh specimen collected by him at Cabo Corrientes, Buenos Ayres. This specimen appears also to have not been fully grown.

Skull.† — In adult specimens the breadth of the skull is a little more than half its length, the point of greatest breadth being at the posterior end of the zygomatic arch. The muzzle or facial portion is broad and high, or greatly produced, much more so even than in *Eumetopias*. The postorbital processes vary from sub-quadrate to sub-triangular, sometimes produced posteriorly into a latero-posteriorly diverging point, as in *Zalophus*. The postorbital cylinder is broad and moderately elongated. The postorbital constriction is well marked, giving a prominently quadrate form to the brain-case, the latero-anterior angles of which vary somewhat in their sharpness in different specimens. The sagittal and occipital crests are well developed in the old males, nearly as much as in *Eumetopias*, as are also the mastoid processes. The palatine bones terminate midway between the last molar teeth and the pterygoid hamuli; their posterior outline is either slightly concave, or deeply and abruptly so. The palatal surface is flat, but slightly depressed posteriorly, and but moderately so anteriorly. The zygomatic foramens are broad, nearly triangular, and truncate posteriorly. The posterior and anterior nares are of nearly equal size in the males, with their transverse and vertical diameters equal; in the females the posterior nares are depressed, their transverse diameter being greater than the vertical. The nasal bones are much broader in front than behind.

The lower jaw is strongly developed, but relatively less massive than

* At St. George's Island, Alaska, August, 1868.

† See Figs. 1–4, Pl. II (males); Figs. 1–4, Pl. III (females); and Figs. 5, 6, 7, Pl. II, and Fig. 9, Pl. III (young).

in *Eumetopias*. The coronoid processes are high and pointed, but much more developed in the males than in the females. The ramial tuberosities are greatly produced, especially the hinder one (see Figs. 8–10, Pl. II).

Measurements of the Skull.

	Adult ♂ No. 2922.	Adult ♂ No. 2923.	Adult ♀ No. 2924.	Adult ♀ No 2925.	Young ♀ No. 2926.	Young ♀ No. 2927.
Length	245	275	185	200	133	137
Breadth	145	155	115	117	85	—
Dist. from ant. edge of intermax. to end of ham. pteryg.	140	165	120	124	68	—
" " " last molar	88	97	63	75	45	—
" " " auditory opening	180	205	135	145	83	92
" " " edge of max. condyle	153	165	120	135	75	83
" palato-max suture to end of ham. pteryg.	68	75	58	58	33	—
Length of left palatine bone	36	37	25	25	15	—
Breadth of left palatine bone opposite last molar	15	13	10	10	5	—
Length of left nasal bone	40	46	—	33	—	17
Breadth of left nasal bone (anteriorly)	16	20	—	11	—	7
" " " (posteriorly)	10	11	—	6	—	5
Breadth of skull at canines	51	56	34	33	21	26
" " " postorbital processes	64	67	42	40	35	36
" " " paroccipital "	130	148	91	95	70	74
" posterior nares (vertical)	23	24	15	13	10	—
" " " (transverse)	23	24	20	21	12	—
" anterior nares (vertical)	36	34	—	23	14	20
" " " (transverse)	35	38	—	23	16	—
Length of zygomatic foramen	77	84	64	68	31	—
Breadth of " "	48	52	40	41	30	—
Greatest height of skull (mast. proc. to top of occip. crest)	110	115	75	76	61	64
Height of skull at hamulus pterygoideus	95	108	—	75	57	—
Length of postorbital cylinder	44	56	29	30	10	6
" brain-case	86	84	80	76	72	75
" the lower jaw	160	176	120	126	—	75
Breadth of lower jaw at its condyles	135	114	90	93	—	—
" " " last molar	52	54	33	35	—	—
" " " symphysis	39	45	24	24	—	—
Height " " coronoid process	60	65	35	37	—	21
" " " symphysis	34	40	23	21	—	12

Teeth. — The molars are closely set in a continuous row. The canines (Fig. 7 *c* and 7 *c'*, Pl. II, upper canines) are large and sharply pointed, the lower slightly curved. The outer upper incisors (Figs. 6 *a* and 7 *a*, Pl. II) are much larger than the others, but relatively smaller than in *Eumetopias*. The middle incisors are flattened antero-posteriorly, and in youth and middle age have their crowns transversely divided (Figs. 6 *a* and 7 *a*, Pl II, upper incisors seen from the side). The lower incisors (Fig. 6 *d*, Pl. II) are similarly divided and are quite small. The crowns of the mo-

lars are sharply conical, with no accessory cusp, or occasionally exceedingly slight ones. All the molars are simple rooted in the specimens I have been able to examine. Some of them have deep median grooves either on the inside or outside of the fangs, or on both sides, which seem to indicate that the fangs are made up of two connate roots. The distinctness of these grooves varies in different specimens (compare Figs. 6 *b* with 7 *c*, Pl. II) and in the corresponding teeth of the two sides of the mouth in the same specimen. Hence it is not improbable that specimens may be found in which the grooves of the fangs may be entirely obsolete, or so deep as to nearly or quite divide the fang into two distinct roots. The roots of the molars are very short, and but partially fill their alveoli; hence when the periosteum is removed they fit so loosely that they require to be cemented in with wax or other substance to prevent their constantly falling out whenever the skull is handled. The canines and the incisors have much longer roots, which more nearly fill their sockets. The roots of the molars are comparatively much shorter and thicker than in *Eumetopias*, and club-shaped, whereas in the latter they are slender and tapering. They are a little shorter than in *Zalophus Gillespii*, which has also short-rooted, loosely fitting teeth.*

Skeleton.—Vertebral formula: Cervical vertebræ, 7; dorsal, 15; lumbar, 5; caudal (including the 4 sacral), 13 to 14 in the males, and 14 to 15 in the females.

The skeleton in its general features resembles that of *Eumetopias Stelleri*, already described. The bones of *C. ursinus* are, however, all slenderer, or smaller in proportion to their length, than in that species, the general form of the body being more elongated. The scapulæ are shorter and broader than in *E. Stelleri*, the proportion of breadth to length being in the one as 11 to 10 and in the other as 13 to 10. The pelvis is more contracted opposite the acetabula in *C. ursinus* than in *E. Stelleri*, and the last segment of the sternum is also longer and narrower. The differences in the skull of the two forms have already been pointed out in the generic comparisons. In proportions, the principal difference, aside from that already mentioned as existing in the form of the scapula, consists in the longer neck and longer hind feet in the *C. ursinus*; the ratio of the length of the cervical vertebræ to the whole length of the skeleton being as 15 to 100 in *E. Stelleri*, and as 23 to 100 in *C. ursinus*; and the ratio of the length of the foot to the tibia being in the former as 13 to 10, and in the other as 16 to 10. The following measurements indicate the length of the principal bones, and of the different vertebral regions.

* Figures of the teeth of this species are given in the Fauna Japonica, Mammals, Pl. XXIII, Figs. 4–9.

Measurements of the Skeleton.

	Adult ♂ No. 2022.	Adult ♂ No. 2023.	Adult ♀ No. 2025	Adult ♀ No. 2024
Whole length of skeleton (including skull) .	2,040	1,840	1,370	1,215
Length of skull	275	245	200	185
" " cervical vertebræ	430	360	200	172
" " dorsal "	770	680	520	470
" " lumbar "	270	245	185	173
" " sacral "	160	145	105	95
" " caudal "	140	145	160	120
" " first rib	212	178	120	110
" " " osseous portion . .	112	105	55	55
" " " cartilaginous portion .	100	73	65	55
" " third rib	395	370	205	175
" " " osseous portion . .	265	210	140	115
" " " cartilaginous portion .	130	90	65	60
" " sixth rib	465	400	323	265
" " " osseous portion . .	350	295	230	190
" " " cartilaginous portion .	115	105	93	75
" " tenth rib	590	—	405	335
" " " osseous portion . .	360	340	265	215
" " " cartilaginous portion .	230	—	140	120
" " twelfth rib, osseous portion only	345	320	210	200
" " fifteenth rib " " "	210	205	150	130
" " sternum	640	590	385	370
" " " 1st segment . .	135	127	76	73
" " " 2d " . .	68	54	37	34
" " " 3d " . .	65	57	39	36
" " " 4th " . .	65	55	40	36
" " " 5th " . .	60	57	40	37
" " " 6th " . .	58	55	40	36
" " " 7th " . .	63	57	43	40
" " " 8th " . .	115	110	70	70
" " scapula	250	217	140	120
Breadth of "	295	285	170	160
Greatest height of its spine	35	27	14	12
Length of humerus	220	220	130	130
" " radius	205	195	128	128
" " ulna	243	223	160	157
" " carpus	55	55	35	35
Breadth " "	100	80	60	55
Length of 1st digit* and its metacarpal bone	250	250	180	177
" " 2d " " " "	245	235	178	—
" " 3d " " " "	215	195	155	—
" " 4th " " " "	170	150	125	—
" " 5th " " " "	127	115	100	—
" " femur	150	135	82	85
" " tibia	250	225	167	157
" " fibula	230	210	145	150
" " tarsus	87	84	57	60
Breadth " "	67	65	40	37
Length of 1st digit† and its metatarsal bone	270	260	200	—
" " 2d " " " "	265	260	—	—
" " 3d " " " "	265	260	—	—
" " 4th " " " "	264	255	—	—
" " 5th " " " "	290	280	—	—

* Fore limb. † Hind limb.

	Adult ♂ No. 2922.	Adult ♂ No. 2923	Adult ♀ No. 2925.	Adult ♀ No. 2924.
Length of innominate bone . . .	234	210	145	140
Greatest (external) width of pelvis anteriorly	115	110	70	75
Width of posterior end of pubic bones .	17	14	30	25
Length of ilium	100	95	60	60
" " ischio-pubic bones . . .	134	110	75	73
" " thyroid foramen . . .	67	63	45	45
Breadth " " " . . .	34	25	20	20

Sexual Differences. — The sexes differ in color, as already stated, in the females being much lighter than the males, or grayer. In respect to the skeleton they differ extraordinarily in the form of the pelvis, as already described,* all the parts of which in the female are greatly reduced in size, and instead of the pubic bones meeting each other posteriorly, as they do in the males, they are widely separated. The innominate bones are also much further apart in the females, and the bones forming the front edge of the pelvis are less developed, so that the pelvis in the female is entirely open in front. In consequence of the remarkable narrowness of the pelvis in the male, the form of this portion of the skeleton is necessarily varied in the female, to permit of the passage of the fœtus in parturition. As already remarked, no such sexual differences are seen in the *Phocidæ*.

In respect to other parts of the skeleton, the absence of the great development of the sagittal and occipital crests seen in the males has already been noticed. The bones of all parts of the skull are much smaller and weaker, especially the lower jaw and the teeth. The attachments for the muscles are correspondingly less developed throughout the skeleton. The most striking sexual difference, however, is that of size; the weight of the full-grown females, according to Captain Bryant, being *less than* ONE SIXTH that of the full-grown males.

Differences resulting from Age. — The differences in color between the young and the adult consist, as already stated, in the young of both sexes during the first three or four months of their lives being glossy black, and gradually afterwards acquiring the color characteristic respectively of the adult males and females. In respect to the differences in the skeleton that distinguish the young, I can only speak of the skull. In regard to this a most striking difference is seen in the relative development of its different regions, as compared with the adult of either sex. The two young skulls before me, said to be from specimens thirty-five days

* In the comparison of the skeleton of the eared seals with that of *Phoca vitulina* (above, p. 25 *et seq.*).

old, are both females, but at this age the sexes probably differ but little in osteological features, especially in those of the skull. In these specimens the anterior or facial portion of the skull is but little developed in comparison with the size of the brain-case. The muzzle is not only excessively short (see Figs. 5–7, Pl. II), but the orbital space is small, and the postorbital cylinder is reduced almost to zero, the postorbital processes being close to the brain-case. The zygomatic arch is hence very short; the zygomatic foramen is as broad as long, instead of being nearly twice as long as broad, as in the adult. On the other hand, the brain-case is exceedingly large, the greatest breadth of the skull being at the middle of the brain-case instead of at the posterior end of the zygomatic arch. As will be seen by the table of measurements of the skull already given, *the brain-case is nearly as large as in the adults*, and the bones being thinner, it must have a capacity about as great as that of the skulls of the adult males and females, there being, in respect to this point, *but slight difference in the sexes*. As the young advance in age, the anterior portion of the skull, or that part in advance of the brain-case, greatly elongates, especially the postorbital cylinder, and increases also in breadth, the skull in a great measure losing the triangular form and the narrow peaked muzzle characteristic of the young. The postorbital processes also greatly change their form as they further develop, as shown in the figures of Plate II.

The limbs are also relatively much larger than in the adult, as mentioned by Quoy and Gaimard in respect to the *Arctocephalus cinereus* of Australia,* which enables them to move on land with greater facility than the adult, as the above-mentioned authors have stated to be the case in the Australian species.

It is not true, however, that the young of *C. ursinus* are devoid of under-fur, as has been by some writers incorrectly stated.†

Individual Variation. — The two males were both not only full-grown, but quite advanced in age, though in all probability the crests of even the older skull (No. 2922) would have been still further developed. The other male (No. 2923) was somewhat younger, but already had the sagittal crest

* Voyage de l'Astrolabe, Zoologie, Tom. I, p. 89.

† It may be added that the young specimens above described had not fully shed their milk teeth. The incisors appear to have been renewed, but both the first and second sets of canines were still present (as shown in Fig. 5, Pl. III, natural size), the permanent ones being in front of the others. The three pre-molars of the first set have been replaced by the permanent ones, the first and second of which are already quite large. The hinder or true molars are in one of the specimens but just in sight, and doubtless had not cut through the gum. In the other specimen they are a little more advanced. The middle one is quite prominent; the first is much smaller, while the last or third true molar is far behind either of the others in development.

considerably produced; the teeth, however, were but moderately worn, the incisors still retaining the groove dividing the surface of the crowns. In the younger male skull the posterior outline of the palatines is but slightly concave, whereas in the other it is deeply and abruptly emarginate in the middle, — as deeply so as in the young (one month old) skulls; — showing that differences in this respect do not necessarily depend upon differences in age. They also differ in the form of the postorbital processes, in the younger they having nearly the same form as in *Eumetopias*, whereas in the older nearly that seen in *Zalophus*. The postorbital cylinder is also much shorter in the younger, though these two skulls do not present nearly the great difference in this respect exhibited by the two very old male skulls of *Zalophus* already described. Another difference is seen in the parieto-maxillary suture. In the younger specimen it is nearly straight and directed forwards, the nasals extending considerably beyond it. In the other it curves at first moderately backwards, and then abruptly in the same direction; the maxillaries extending in this case slightly beyond the nasals, instead of ending considerably in front of the end of the latter. The nasals themselves are much narrower in the younger specimen, especially anteriorly, and hence have very different forms in the two specimens.

In respect to the teeth, it may be added that the older skull has *seven* upper molars on one side and *six* on the other, the normal number being six on each side. The form of the molar teeth, especially of the fangs, differ markedly in the two skulls; those of the younger having the longitudinal grooves of the fangs of nearly all the teeth almost wholly obsolete, while in the other specimen the roots of nearly all the molars are more or less strongly grooved.

Of the two female skulls one is very aged,* as shown by the closed sutures and the greatly worn and defective teeth. The younger, however, is also quite advanced in years. Differences of a similar character to those seen in the males also occur between these, but they are less marked.

There are also considerable variations in color. Not only is one of the young females much darker below and about the face than the other, but one

* Respecting the age of these specimens of fur seals, Captain Bryant has responded to my inquiries as follows: "The grown females (the mothers of the pups) were average specimens. The only means I had of determining their age was by the evidences afforded by dissection. These were that the older female had given birth to seven young, and the other to five, which would make their ages respectively ten and eight years. The two grown males were also selected as average specimens in size and color. Judging from their general appearance and color, I estimated them to be ten years old. The two pups were thirty-five days old, and in that time had doubled their size from birth. They were both females."

of the old females is much darker than the other, while similar variations are seen in the males.

General Remarks. — The northern sea bear (*Callorhinus ursinus*) was first made known by Steller in 1751, under the name of *Ursus marinus*. On his visit to Kamtchatka and its neighboring islands, in 1742, he met with these animals in great numbers at Behring's Island, where he spent several weeks among them, and carefully studied their habits and anatomy. On his return to St. Petersburg he published a detailed and accurate description of them in his valuable essay entitled *De Bestiis Marinis*, in the Transactions of the St. Petersburg Academy for the year 1749.* This valuable memoir has furnished nearly all the information concerning the northern sea bears we have hitherto had. Steller's account, occupying twenty-eight quarto pages, gave not only a detailed description of its anatomy, with an extensive table of measurements, but also of its remarkable habits, and figures of the animals. His description of its habits has been largely quoted by Buffon and Pennant, and by Hamilton, in his history of the "Marine Amphibia."† Kraschenninikow, in his History of Kamtchatka.‡ under the name of the "sea cat," also gave a lengthy account of its habits, apparently mainly from Steller's notes; but it embraces a few particulars not given in the *De Bestiis Marinis*. Buffon, followed by Pennant, and most general writers for half a century, confounded the northern sea bear with the southern sea bear, they combining the history of the two as that of one species. When specimens of both the northern and southern fur seals had been compared in Europe, their specific distinctness became fully recognized, and in 1859 they were even generically separated by Dr. J. E. Gray, since which time they have been generally recognized as belonging to different genera. In color, size, and the character of the pelage they are undoubtedly closely related, as they seem to be also in habits, but they differ greatly in the form of the facial portion of the skull, and hence in physiognomy, through the much greater breadth of the muzzle in the northern species, and its abruptly rising and convex nose.

* Novi Commentariæ Academiæ Petropolitanæ, Vol. XI, pp 331–359, pl. xv. 1751.

† Naturalist's Library, Mammalia, Vol. VIII, 1839.

‡ History of Kamtchatka (English edition), translated from the Russian by James Grieve, M. D., pp. 125–130, 1764.

Steller's figures were the only original ones of this species that had been published up to a recent date, which, with modifications, have been frequently copied. Those given by Hamilton (Plate XXI of his work above cited) are among the best, and are quite accurate in general form, but erroneous in details, especially in respect to the feet. Choris, in 1822, gave a plate purporting to represent a group of sea bears, as they appear when assembled on the rocks at their breeding-places. Though doubtless giving a good idea of their attitudes at such times, as the other plate in his chapter on the Aleutian Islands, purporting to represent the sea lions, does of those animals; but they are not sufficiently detailed to be of further value. Mr. Dall, in his book on "Alaska and its Resources" (previously cited), has published a figure from nature of this species, which, while doubtless generally correct, gives a somewhat erroneous impression in regard to the character of the hind feet, since the upper surface is represented as being strongly ridged and furrowed, the ridges extending to the ends of the flaps, which are really flat.*

The first and only specimen of the *skull* hitherto figured is that of a male, represented in profile, published by Dr. Gray in the Proceedings of the Zoölogical Society for 1859 (Plate LXVIII).

As already remarked, the sea bears of the North were for a long time confounded with the southern sea bears, they collectively bearing the name of either *Phoca* or *Otaria ursina*. This name was originally, however, applied by Schreber and Linné to the *Ursus marinus* of Steller, to which animal the name *ursina* is hence exclusively applicable.

Forster and Cook, and other voyagers, subsequently described the southern sea bears, so far as respects their general habits, size, and abundance. Most of these writers seem to have regarded these animals as the same as the northern sea bear, and, as already stated,

* It is remarkable how few correct figures have been published of the eared seals, even those in scientific works being palpably erroneous, and contradictory of the characters given in the descriptions accompanying them. In nearly all cases the feet are represented as covered with hair, as in the common seals, and similarly provided with well-developed nails on both the fore and hind limbs. In this respect even the figures given by Quoy and Gaimard, in the Zoölogy of the *Voyage de l'Astrolabe*, are faulty, not corresponding at all in this regard with the accompanying descriptions of the animals. The figures of the *Otaria jubata*, published in the Proceedings of the London Zoological Society (1866, p. 80, woodcut; 1869, Pl. VII) seem to be those most nearly approaching accuracy.

naturalists for a long time generally confounded them. Péron, in 1816, first claimed that they were distinct, but no specimens seem to have reached European museums till some years later. Dr. Gray, writing in 1859, remarks as follows: "I had not been able to see a specimen of this species in any of the museums which I examined on the Continent or in England, or to find a skull of the genus [*Arctocephalus*] from the North Pacific Ocean, yet I felt so assured, from Steller's description and the geographical position, that it must be distinct from the eared fur seals from the Antarctic Ocean and Australia, with which it had usually been confounded, that in my 'Catalogue of Seals in the Collection of the British Museum' [1850] I regarded it as a distinct species, under the name of *Arctocephalus ursinus*, giving an abridgment of Steller's description as its specific character." "The British Museum," he adds, "has just received, under the name *Otaria leonina*, from Amsterdam, a specimen [skull and skin] of the sea bear from Behring's Straits, which was obtained from St. Petersburg"*; which is the specimen already spoken of as figured by Dr. Gray. From the great differences existing between this skull and those of the southern sea bears, Dr. Gray separated the northern species from the genus *Arctocephalus*, under the name *Callorhinus*.†

Although there were two skulls of Steller's sea bear in the Berlin Museum as early as 1841,‡ and three skeletons of the same species in the Museum of Munich in 1849,§ Dr. Gray seems to have been the first naturalist who was able to compare this animal with its southern relatives, and hence to positively decide its affinities.

Misled by a label accompanying specimens of eared seals received at the British Museum from California, a skin of the *Callorhinus ursinus* was doubtfully described by this author, in the paper in which the name *Callorhinus* was proposed, as that of his *Arctocephalus monteriensis*, which is a hair seal. This skin was accompanied by a young skull, purporting, by the label it bore, to belong to it, but Dr. Gray observes that otherwise he should have thought it too small to have belonged to the same animal. Seven years later,‖ however, he described the

* Proc. London Zool. Soc., 1859, p. 102.

† Ibid., p. 359.

‡ Archiv für Naturgeschichte, etc, 1841, p. 334.

§ Ibid., 1849, p. 39.

‖ Cat. Seals and Whales, 1866, p. 51.

skull as that of a new species (*Arctocephalus californianus*), still associating with it, however, the skin of the *Callorhinus ursinus*. The skull he subsequently considered as that of a young *A. monteriensis* (= *Eumetopias Stelleri*); and referring his *A. californianus* to that species, he was consequently led into the double error of regarding the *Eumetopias Stelleri* as a fur seal (as already explained under that species and elsewhere in the present paper), and of excluding the *Callorhinus ursinus* from the list of fur seals.

Geographical Distribution. — The northern fur seal seems to be nowhere so numerous at present as at the St. Paul's and St. George's Islands, off the coast of Alaska. They seem to still occur, however, in considerable numbers at a few of the islands to the northward and westward, especially at St. Matthew's and Behring's Islands. They appear never to have landed on the Asiatic shores to any great extent, and I have found no report of their occurrence to the southward of the Kuriles on that coast. On the American side they were formerly numerous from Sitka to the southern coast of California. At Point Conception, Captain Bryant informs me, large numbers were formerly taken, but that they are now rare on the California coast, and are only seen there in the winter season. "The present year," he writes me,* "unusually large numbers have been seen off the coasts of Oregon, Washington Territory, and British Columbia, and many skins have been taken and brought to San Francisco. They were mostly of very young seals, none appearing to be over a year old. Formerly in March and April the natives of Puget Sound took large numbers of pregnant females, but no places where they have resorted to breed seem to be known off this coast. Neither can I ascertain that any rookeries of the hair seals, or sea lions, are known to exist here; but I think it probable that both species occupy the rocky ledges off the shore, which are rarely visited by boats."

The northern fur seals seem to require a moderately cool and humid climate, since they do not readily bear the heat of the sun. These conditions apparently existing in an eminent degree at the Pribyloff Islands, these islands, as Captain Bryant remarks beyond, are eminently suited to the wants of these animals, which, according to his computation, resort there in summer to the number of more than a million.

* Under date of June 14, 1870, from the United States revenue cutter "Lincoln," *en route* for the Seal Islands of Alaska.

At Behring's and the Pribyloff Islands the fur seals are reported to make their appearance from the southward late in spring, and that they only resort to these islands for the purposes of reproduction, and leave them early in the autumn. Their haunts at other seasons seem not to be well known, but it is evident that their winter quarters must be to the southward of these islands. That there is a southward migration of these animals in winter is evident from their reported greater frequency at that season on the Pacific coast of the United States.

Habits. — The very full account of the habits of this species, contained in the following communication of Captain Bryant, together with the accompanying notes, require nothing to be added on this point in the present connection.

II.

On the Habits of the Northern Fur Seal (Callorhinus ursinus *Gray*), *with a Description of the Pribyloff Group of Islands.* *By* Captain Charles Bryant, *with Notes by* J. A. Allen.

Description of the Pribyloff Group of Islands.

Discovery. — The group of several small islands, known as the Pribyloff Group, were discovered under the following circumstances. Captain Pribyloff, who in 1781 took charge of the Russian trading factory at Ounalaska, observed during his voyages among the islands to the westward of Ounalaska numbers of fur seals going north in spring and returning in autumn. Believing that there must be unknown land to the northward to which these animals resorted, he fitted out an expedition for the purpose of discovering it, and in June, 1785, while cruising for that purpose, discovered an island. He took possession of this island, colonized it, and called it St. George's, from the vessel in which the discovery was made. On a clear day, during the following year, these colonists saw another island to the northward of the first, and visiting it in their canoes, proceeded to occupy it. The island was called St. Paul's, from its discovery being made on St. Paul's day.

St. Paul's Island. — St. Paul's Island, of which I append an outline sketch (Fig. 5) is nearly triangular, and sixteen miles in length. Its northern side is a little concave. Its greatest breadth is four miles, at